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INFANT MORTALITY AND ITS RELATION TO  
WOMAN'S EMPLOYMENT: A STUDY OF  
MASSACHUSETTS STATISTICS

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# INFANT MORTALITY AND ITS RELATION TO WOMAN'S EMPLOYMENT: A STUDY OF MASSACHUSETTS STATISTICS

BY

EDWARD BUNNELL PHELPS, M.A., F.S.S.

Editor, THE AMERICAN UNDERWRITER, of New York City, and Author of  
A Statistical Study of Infant Mortality, A Statistical Survey of Infant  
Mortality's Urgent Call for Action, The World-Wide  
Effort to Diminish Infant Mortality—Its Present  
Status and Its Possibilities, etc., etc.

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Annex.

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PART I.

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INFANT MORTALITY AND ITS RELATION TO  
WOMAN'S EMPLOYMENT: A STUDY OF  
MASSACHUSETTS STATISTICS.

BY EDWARD BUNNELL PHELPS.

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# INFANT MORTALITY AND ITS RELATION TO WOMAN'S EMPLOYMENT: A STUDY OF MASSACHUSETTS STATISTICS.

## INTRODUCTION.

### IMPORTANCE OF DEATH RATE UNDER 1 YEAR AS COMPARED WITH GENERAL DEATH RATE.

Infant mortality, or the deaths of children under 12 months of age, is generally recognized as one of the most complex social problems of the present day. The first fact which entitles it to a place among our most serious social problems is its magnitude as compared with the general death rate. Despite the lack of mortality records for the whole United States, and the many and serious defects of those for many of the registration States, the registration area of the Twelfth Census was sufficiently large to produce in its figures an approximate index of the mortality of the country at large. Checked up as are these figures of mortality in various age groups by those of England and Wales, France, and various other foreign countries with established systems of registering vital statistics, they probably record with approximate accuracy the death rate under age 1, as compared with the ratio of deaths at other ages.

In a recent statistical study of this subject,<sup>a</sup> it was shown (the figures being restricted to the registration States—and omitting the registration cities in nonregistration States in order to eliminate the abnormally high mortality of the colored population in the registration cities of the South) that the rate of deaths per 1,000 living population under age 1, in the registration States in 1900, apparently was 159.3, as contrasted with a death rate of only 14.1 per 1,000 population over age 1. In other words, the death rate of the census year 1900, in the registration States, in the case of infants under 1 year of age was more than eleven times as high as at all other ages of childhood and adult life, as measured by the ratio of deaths to living population in both age groups. This comparison is probably approximately correct, though the returns of all censuses of population under age 1 are somewhat unreliable owing to the carelessness of parents in reporting as "one-year-old" babies within a few months, under or over, that age.

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<sup>a</sup> Edward B. Phelps: A Statistical Study of Infant Mortality. Quarterly Publications of the American Statistical Association, new series, No. 83 (September, 1908), pp. 266-268.

## STABILITY OF DEATH RATE UNDER 1 YEAR.

The second fact concerning infant mortality which has attracted the attention of those who have investigated the subject is, that the infant death rate as compared with that at higher ages has shown so little improvement during a long period. It has not responded adequately to improvements in public sanitation and medical practice. A recent English writer<sup>a</sup> on the subject has commented on this aspect of the problem: "Whilst during the last half century, a time of marvellous growth of science and of preventive medicine, human life has been saved and prolonged, and death made more remote for the general population, infants still die every year much as they did in former times. Indeed, in many places it appears that they die in greater numbers, and more readily than in the past."

In many cities and in some countries there apparently has been a decrease in the infant death rate of late years, but this decrease has not been sufficiently widespread or extended through a sufficiently long period of years to lessen the seriousness of the situation.

## INFANT MORTALITY RATE DEFINED.

Before proceeding further, it is necessary to explain the method by which the infant mortality rate is usually computed, and the difference between that rate and an ordinary death rate.

By the infantile mortality rate is meant "the proportion which the deaths of such infants bear to every 1,000 births. An ordinary death rate is the proportion which the total deaths of a community bear to 1,000 of the population in such a community. But it is clear that a more accurate death rate for infants is obtained if we compare the total number of infant deaths not to 1,000 of the general population, but to 1,000 births in the same year."<sup>b</sup>

In the presentation of infantile mortality rates, stillbirths are usually excluded, and this practice has been followed in the present case. The only exception in this study to the above method of expressing the infant death rate is in the statement above from the United States Census, in which the infant death rate for the registration area for 1900 is stated as 159.3 per 1,000 living population under age 1.

## INFANT MORTALITY RATES IN MASSACHUSETTS, 1856 TO 1903.

The State of Massachusetts early established a registration system, and for this reason is recognized as the most reliable index of American vital statistics. The following table, compiled from registration re-

<sup>a</sup> George Newman, M. D.: *Infant Mortality—A Social Problem*. London, 1906, p. 2.

<sup>b</sup> Newman: *Infant Mortality*, p. 1.

ports of that State and adapted from a statistical study <sup>a</sup> of infant mortality to which reference has already been made, clearly illustrates the fact that the infant death rate, when considered through a long period of years, and in sufficiently long time intervals to remove superficial tendencies, can not as yet be said to show a marked decline:

BIRTHS AND DEATHS UNDER 1 YEAR AND THEIR RATE PER 1,000 BIRTHS IN MASSACHUSETTS BY FIVE-YEAR PERIODS FOR THE FIFTY-THREE YEARS, 1856 TO 1908, STILLBIRTHS EXCLUDED IN BOTH CASES.

[Compiled from the Twenty-eighth Annual Report of the Massachusetts Board of Health, 1896, p. 750, and Sixty-seventh Registration Report of Massachusetts, 1908, p. 207.]

| Years.         | Living births. | Deaths under 1 year. |                        |
|----------------|----------------|----------------------|------------------------|
|                | Number.        | Number.              | Rate per 1,000 births. |
| 1856-1860..... | 175,729        | 21,579               | 122.8                  |
| 1861-1865..... | 158,732        | 23,490               | 148.0                  |
| 1866-1870..... | 179,740        | 26,457               | 147.2                  |
| 1871-1875..... | 217,134        | 37,498               | 172.7                  |
| 1876-1880..... | 209,749        | 32,277               | 153.9                  |
| 1881-1885..... | 235,580        | 37,709               | 160.1                  |
| 1886-1890..... | 273,707        | 43,962               | 160.6                  |
| 1891-1895..... | 330,501        | 53,288               | 161.2                  |
| 1896-1900..... | 362,501        | 55,560               | 153.3                  |
| 1901-1905..... | 367,815        | 50,807               | 138.1                  |
| 1906.....      | 80,237         | 11,106               | 138.4                  |
| 1907.....      | 85,001         | 11,293               | 132.9                  |
| 1908.....      | 86,911         | 11,606               | 133.5                  |

#### INFANT MORTALITY RATES IN ENGLAND AND WALES, 1861 TO 1909.

This relatively slight decline in the infant death rate is by no means peculiar to Massachusetts. The statistics of births and deaths in England and Wales are known to be fairly reliable, and a recent table covering the period 1861 to 1908, prepared by Dr. Arthur Newsholme, medical officer to the Local Government Board, not only shows how relatively small has been the decline of infant mortality in that country, but presents in striking contrast the rapid decline during the same period in child mortality from the beginning of the second to the close of the fifth year of life. This table, which is reproduced below, shows the average death rates per 1,000 at each age and the relative mortality figures, the death rates for the period 1861 to 1865 being taken as the basis or 100.

<sup>a</sup> Phelps: A Statistical Study of Infant Mortality. Quarterly Publications of the American Statistical Association, new series, No. 83 (September, 1908), p. 257.



DEATH RATES OF INFANTS UNDER 1 YEAR OF AGE AND FOR EACH OF THE NEXT FOUR YEARS OF LIFE, WITH RELATIVE MORTALITY FIGURES, FOR ENGLAND AND WALES, BY FIVE-YEAR PERIODS, 1861 TO 1909.

[From the Thirty-ninth Annual Report of the Local Government Board, 1909-10, Supplement to the Report of the Board's Medical Officer, containing a Report by the Medical Officer on Infant and Child Mortality. London, 1910, p. 15.]

| Year.          | Average death rates per 1,000 at each age. |            |            |            |            | Relative mortality figures, the death rate in 1861-1865 being stated as 100. |            |            |            |            |
|----------------|--------------------------------------------|------------|------------|------------|------------|------------------------------------------------------------------------------|------------|------------|------------|------------|
|                | 0-1 year.                                  | 1-2 years. | 2-3 years. | 3-4 years. | 4-5 years. | 0-1 year.                                                                    | 1-2 years. | 2-3 years. | 3-4 years. | 4-5 years. |
| 1861-1865..... | 155                                        | 69         | 37         | 25         | 18         | 100                                                                          | 100        | 100        | 100        | 100        |
| 1866-1870..... | 157                                        | 63         | 32         | 22         | 16         | 102                                                                          | 92         | 88         | 88         | 90         |
| 1871-1875..... | 154                                        | 59         | 28         | 19         | 14         | 100                                                                          | 86         | 77         | 76         | 81         |
| 1876-1880..... | 145                                        | 58         | 27         | 17         | 13         | 94                                                                           | 85         | 74         | 68         | 74         |
| 1881-1885..... | 139                                        | 53         | 23         | 15         | 12         | 90                                                                           | 78         | 64         | 60         | 69         |
| 1886-1890..... | 144                                        | 53         | 22         | 14         | 10         | 93                                                                           | 78         | 61         | 56         | 58         |
| 1891-1895..... | 151                                        | 52         | 21         | 14         | 10         | 98                                                                           | 76         | 58         | 56         | 58         |
| 1896-1900..... | 156                                        | 49         | 19         | 13         | 9          | 101                                                                          | 72         | 53         | 52         | 50         |
| 1901-1905..... | 138                                        | 41         | 16         | 11         | 8          | 90                                                                           | 60         | 44         | 44         | 46         |
| 1906-1908..... | 124                                        | 37         | 15         | 9          | 7          | 80                                                                           | 53         | 41         | 36         | 40         |
| 1909 a.....    | 109                                        | 33         | 14         | 9          | 7          | 70                                                                           | 48         | 38         | 36         | 39         |

a Figures for 1909 from Seventy-second Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, 1911.

From the above table it will be seen that the mortality rate under 1 year has decreased from an average of 155 per 1,000 in the period 1861-1865 to 124 per 1,000 in the years 1906-1908; or, expressed in the relative mortality figures, taking the first period as a basis, they have decreased from 100 to 80. It is only in the last period, however, that so low a figure appears, no previous period having shown a relative mortality figure below 90, and in the five-year period 1896 to 1900 the average was 101. It is scarcely safe to assume, therefore, that the mortality figure of 80, which is shown for the last period, can be accepted as indicating a level showing permanently bettered conditions. When the relative mortality figures under 1 year are compared with those for the other ages under 5 years, it will be seen that a far greater gain has been made at the higher ages, the figures in 1909 at 4 to 5 years being 39 and at 3 to 4 years being 36.

These facts might at first glance seem to indicate that the infant mortality rate is incapable of any considerable reduction. But there is ample evidence that a rate so high as that for Massachusetts, or as that for England and Wales, is an index of bad conditions, which can be mended.

#### WIDE RANGE OF INFANT MORTALITY RATES IN DIFFERENT COUNTRIES.

The following table, from the latest report of the registrar-general of the United Kingdom, is of interest in this connection, as showing the wide range of infant mortality rates in various countries:

BIRTH RATES, AND DEATH RATES UNDER 1 YEAR PER 1,000 BIRTHS (STILLBIRTHS EXCLUDED) FOR THE PRINCIPAL FOREIGN COUNTRIES, BY FIVE-YEAR PERIODS, 1881 TO 1909.

BIRTHS PER 1,000 POPULATION.

[From Seventy-second Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, 1909.]

| Countries.             | 1881-1885. | 1886-1890. | 1891-1895. | 1896-1900. | 1901-1905. | 1906. | 1907. | 1908. | 1909. |
|------------------------|------------|------------|------------|------------|------------|-------|-------|-------|-------|
| Europe:                |            |            |            |            |            |       |       |       |       |
| Norway.....            | 31.2       | 30.8       | 30.2       | 30.1       | 28.6       | 26.7  | 26.3  | 26.2  | 26.1  |
| Ireland.....           | 23.9       | 22.8       | 23.0       | 23.3       | 23.2       | 23.6  | 23.2  | 23.3  | 23.5  |
| Sweden.....            | 29.4       | 28.8       | 27.4       | 26.9       | 26.1       | 25.7  | 25.5  | 25.7  | 25.6  |
| Bulgaria.....          | 37.2       | 35.9       | 37.5       | 41.0       | 40.6       | 44.0  | 43.6  | 40.4  | (a)   |
| Scotland.....          | 33.3       | 31.4       | 30.5       | 30.0       | 28.9       | 27.9  | 27.0  | 27.2  | 26.4  |
| Denmark.....           | 32.4       | 31.4       | 30.4       | 30.0       | 29.0       | 28.5  | 28.3  | 28.3  | 28.0  |
| Finland.....           | 35.5       | 34.5       | 31.8       | 32.6       | 31.3       | 31.4  | 31.3  | 30.8  | 31.3  |
| England and Wales..... | 33.5       | 31.4       | 30.5       | 29.3       | 28.1       | 27.1  | 26.3  | 26.5  | 25.6  |
| Switzerland.....       | 28.6       | 27.5       | 27.7       | 28.5       | 28.1       | 27.4  | 26.8  | 27.1  | (a)   |
| Belgium.....           | 30.7       | 29.3       | 28.9       | 28.9       | 27.7       | 25.7  | 25.3  | 24.9  | (a)   |
| Servia.....            | 46.3       | 43.7       | 43.3       | 40.1       | 38.7       | 41.3  | 40.0  | 36.8  | 36.5  |
| France.....            | 24.7       | 23.1       | 22.3       | 21.9       | 21.2       | 20.6  | 19.7  | 20.2  | 19.6  |
| The Netherlands.....   | 34.8       | 33.6       | 32.9       | 32.1       | 31.5       | 30.4  | 30.0  | 29.7  | 29.1  |
| Italy.....             | 38.0       | 37.5       | 36.0       | 34.0       | 32.6       | 31.9  | 31.5  | 33.4  | 32.4  |
| Spain.....             | 36.4       | 36.0       | 35.3       | 34.3       | 35.0       | 33.4  | 32.9  | 33.2  | 32.6  |
| Prussia.....           | 37.4       | 37.3       | 37.0       | 36.5       | 34.8       | 33.8  | 33.0  | 32.8  | 31.8  |
| Roumania.....          | 41.8       | 40.9       | 41.0       | 40.2       | 39.4       | 40.5  | 41.7  | 40.8  | 41.7  |
| Austria.....           | 38.2       | 37.8       | 37.4       | 37.3       | 35.6       | 34.9  | 33.8  | 33.5  | (a)   |
| Hungary.....           | 44.6       | 43.7       | 41.7       | 39.4       | 37.2       | 36.0  | 36.0  | 36.3  | 37.0  |
| Russia in Europe.....  | 49.1       | 48.2       | 48.2       | 49.3       | (a)        | (a)   | (a)   | (a)   | (a)   |
| Australasia:           |            |            |            |            |            |       |       |       |       |
| New Zealand.....       | 36.3       | 31.2       | 27.7       | 25.7       | 26.6       | 27.1  | 27.3  | 27.4  | 27.3  |
| Tasmania.....          | 35.0       | 34.1       | 32.7       | 28.2       | 29.0       | 29.5  | 29.6  | 30.8  | 29.9  |
| South Australia.....   | 38.5       | 34.7       | 32.0       | 27.0       | 24.5       | 23.7  | 23.9  | 24.7  | 24.7  |
| Queensland.....        | 36.5       | 37.4       | 34.1       | 29.1       | 26.7       | 26.3  | 26.9  | 26.7  | 27.2  |
| New South Wales.....   | 37.7       | 36.4       | 32.9       | 28.0       | 26.7       | 27.0  | 27.1  | 26.8  | 26.9  |
| Victoria.....          | 30.8       | 32.7       | 30.9       | 26.2       | 25.0       | 25.1  | 25.2  | 24.6  | 24.6  |
| Western Australia..... | 34.5       | 36.9       | 30.7       | 28.3       | 30.3       | 30.0  | 29.2  | 28.9  | 27.7  |
| Other countries:       |            |            |            |            |            |       |       |       |       |
| Japan.....             | (a)        | 28.5       | 28.6       | 31.1       | 31.7       | 28.9  | 33.0  | 33.9  | (a)   |
| Ceylon.....            | (a)        | 30.3       | 31.7       | 37.1       | 38.8       | 35.7  | 32.8  | 40.1  | 36.7  |
| Jamaica.....           | (a)        | 36.8       | 38.6       | 38.9       | 39.0       | 38.1  | 35.0  | 37.6  | 37.8  |
| Chili.....             | 39.1       | 35.5       | 37.0       | 35.0       | 36.1       | 36.6  | 38.6  | 39.3  | 38.8  |

DEATHS UNDER 1 YEAR PER 1,000 BIRTHS.

|                        |     |     |     |     |     |     |     |     |     |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Europe:                |     |     |     |     |     |     |     |     |     |
| Norway.....            | 99  | 96  | 98  | 96  | 81  | 69  | 67  | 76  | (a) |
| Ireland.....           | 94  | 95  | 102 | 106 | 98  | 93  | 92  | 97  | 92  |
| Sweden.....            | 116 | 105 | 103 | 101 | 91  | 81  | 77  | 85  | (a) |
| Bulgaria.....          | (a) | (a) | 140 | 143 | 148 | 154 | 154 | 170 | (a) |
| Scotland.....          | 117 | 121 | 126 | 129 | 120 | 115 | 110 | 121 | (a) |
| Denmark.....           | 135 | 136 | 133 | 132 | 119 | 109 | 106 | 123 | (a) |
| Finland.....           | 162 | 144 | 145 | 139 | 131 | 119 | 112 | 125 | 111 |
| England and Wales..... | 139 | 145 | 151 | 156 | 138 | 132 | 118 | 120 | 109 |
| Switzerland.....       | 171 | 159 | 155 | 143 | 134 | 127 | 121 | 108 | (a) |
| Belgium.....           | 166 | 163 | 164 | 158 | 148 | 153 | 132 | 147 | (a) |
| Servia.....            | 157 | 158 | 172 | 159 | 149 | 144 | 147 | 158 | (a) |
| France.....            | 167 | 166 | 171 | 159 | 139 | 143 | 135 | (a) | (a) |
| The Netherlands.....   | 181 | 175 | 165 | 151 | 136 | 127 | 112 | 125 | 99  |
| Italy.....             | (a) | (a) | 185 | 168 | 168 | 160 | 155 | 153 | (a) |
| Spain.....             | 193 | (a) | (a) | (a) | 173 | 173 | (a) | (a) | (a) |
| Prussia.....           | 207 | 208 | 205 | 201 | 190 | 177 | 168 | 173 | 164 |
| Roumania.....          | 179 | 195 | 219 | (a) | (a) | (a) | (a) | (a) | (a) |
| Austria.....           | (a) | (a) | (a) | 226 | 215 | 209 | 204 | (a) | (a) |
| Hungary.....           | (a) | (a) | 250 | 219 | 212 | 205 | 208 | 199 | 212 |
| Russia in Europe.....  | 271 | 264 | 276 | 261 | (a) | (a) | (a) | (a) | (a) |
| Australasia:           |     |     |     |     |     |     |     |     |     |
| New Zealand.....       | 90  | 84  | 87  | 80  | 75  | 62  | 89  | 68  | 62  |
| Tasmania.....          | 109 | 103 | 94  | 98  | 90  | 91  | 82  | 75  | 65  |
| South Australia.....   | (a) | 105 | 99  | 112 | 87  | 76  | 66  | 70  | 61  |
| Queensland.....        | 137 | 119 | 103 | 103 | 94  | 75  | 77  | 70  | 72  |
| New South Wales.....   | 124 | 115 | 111 | 113 | 97  | 75  | 89  | 76  | 74  |
| Victoria.....          | 122 | 131 | 111 | 111 | 96  | 93  | 73  | 86  | 71  |
| Western Australia..... | (a) | 123 | 130 | 160 | 126 | 110 | 98  | 85  | 78  |
| Other countries:       |     |     |     |     |     |     |     |     |     |
| Japan.....             | (a) | (a) | 147 | 153 | 154 | 153 | 151 | 157 | (a) |
| Ceylon.....            | (a) | 158 | 169 | 168 | 171 | 198 | 186 | 183 | 202 |
| Jamaica.....           | (a) | 170 | 171 | 175 | 174 | 197 | 223 | 175 | 174 |
| Chili.....             | (a) | 264 | 336 | 333 | 331 | 328 | 297 | 320 | (a) |

a Not reported.



It will be seen that for several countries the infant mortality rate through the entire period of twenty-nine years covered has been below or only slightly above 100 deaths per 1,000 births, namely, Norway, Ireland, Sweden, New Zealand, Tasmania, and South Australia. Various estimates have been made as to the proportion of infant deaths which are preventable, and considerable discussion, more or less academic, has taken this preventable proportion for its theme. It is clearly impracticable to attempt to determine an absolute infant mortality rate attainable by all countries; but it is reasonable to conclude, even allowing for a considerable margin of error in the statistics of the subject, that if the countries named have through a long period of years enjoyed the degree of infantile health indicated by the above table the infantile mortality rate of Massachusetts and of the entire registration area of the United States is quite too high and demands attention.

#### RELATION OF HIGH INFANT MORTALITY RATES TO RATES AT LATER AGES.

It has frequently been argued that a high infant mortality has a selective influence; in other words, that it acts as a "weeding-out process," and hence tends to reduce mortality at later ages. This contention was one of the main points recently investigated by the medical officer of the British Local Government Board, and the results of his inquiry are embodied in the recent report referred to above.<sup>a</sup> Doctor Newsholme, with the records of the registrar-general of births, deaths, and marriages as a basis, concludes as follows: "Infant mortality is the most sensitive index we possess of social welfare and of sanitary administration, especially under urban conditions. A heavy infant mortality implies a heavier death rate up to 5 years of age; and right up to adult life the districts suffering from a heavy child mortality have higher death rates than the districts whose infant mortality is low. A careful study of the death rate in England and Wales during the last fifty years, at each of the first five years of life, leaves it doubtful whether any appreciably greater selection or 'weeding out' is exercised by a heavier than by a lighter infantile mortality. Any such effect, if it exists, is concealed behind the overwhelming influence exerted by the evil environment to which children are exposed in districts of high infant mortality. It is strictly correct, therefore, to say that a high infant mortality implies a high prevalence of the conditions which determine national inferiority." Thus in effective fashion he has summed up the second grave circumstance which has made a high infant mortality a social problem. It is a

<sup>a</sup> Great Britain, Local Government Board. 39th Annual Report. Supplement on Infant and Child Mortality, pp. 74, 75.

problem, first, because of its magnitude. It is a needless sacrifice of human life. It is a problem, in the second place, because it is an index of the general environmental conditions which make for deterioration.

**FACTORS IN INFANT MORTALITY RATE, AS GENERALLY RECOGNIZED.**

Although the problem of effecting any material decrease in the infant death rate is yet to be solved, certain factors are now generally recognized as related to it. They fall naturally into two groups. The first group may be termed the general conditions of sanitation which affect the health of the entire community, but show an especial relation to the death rate of infants, namely, (1) urban or rural conditions of life, (2) domestic and municipal sanitation—that is to say, condition of the streets, methods of sewage removal, purity of the milk and water supply, and related matters—and (3) the housing of the wage-working population.

The second group may be termed the social condition of the population as it shows itself in (1) the ignorance or intelligence of the people, but especially of the mothers, (2) the degree of economic well-being of the majority of the inhabitants of any region under consideration, (3) the prevalence or absence of extra-domestic employment of married women, (4) whether or not the custom of very early marriage prevails with the female portion of the population, (5) the proportion of legitimate to illegitimate births, and (6) the size of the birth rate.

**DOCTOR GREENHOW'S CONCLUSIONS AS TO RELATION OF WOMEN'S WORK TO INFANT MORTALITY.**

In the absence of exact information, the many discussions of the subject during the last fifty years have assigned a varying importance to these different factors. Certain of them, however, have been accepted almost unanimously as being of great importance, and among these the extra-domestic employment of married women has been regarded as fundamental. This relation of women's work to infant mortality was apparently first formulated in an official document by Sir John Simon, in a public health report of Great Britain in June, 1858.<sup>a</sup>

This factor was further emphasized by him in subsequent statements,<sup>b</sup> and in 1861 Doctor Greenhow, medical officer of the privy

<sup>a</sup> Great Britain. Public Health Reports, vol. 1, p. 460.

<sup>b</sup> English Sanitary Institutions, 1890, p. 298; Papers relating to the Sanitary State of the People of England, 1858, pp. xxiv, 132; Fourth Report of the Medical Officer of the Privy Council, 1861, pp. 187-196.

council, after elaborate investigations in a number of industrial towns, stated his conclusions with regard to it as follows:

1. The infantile death rate bears no definite relation to the general death rate, but their comparative proportions to each other vary in different districts.

2. The infantile death rate bears the largest proportion to the general death rate in districts where the infantile population is especially exposed to unwholesome influences, as in Coventry, Nottingham, and certain other manufacturing towns.

3. The unwholesome influences to which infants are exposed in the manufacturing towns comprised in the present inquiry may be attributed mainly to the industrial employment of the married women, which leads them to consign the tendance of their infants, at a very early age, to young children or strangers.

4. That infants thus deprived of the mother's care are habitually fed on diet ill adapted to their digestive powers, and are very frequently drugged with opiates in order to allay the fractiousness arising from the illness induced by improper food.

5. That infants in manufacturing towns where women are much engaged in factory labor are likewise exposed to other causes of sickness proceeding from the ignorance or carelessness of the mothers or nurses, such as deficiency of exercise and exposure to inclement weather.<sup>a</sup>

Doctor Greenhow's statement since that day has been generally accepted as a satisfactory summary of an acknowledged fact, but very recently a more accurate statistical and medical knowledge has opened the entire question of infant mortality for a critical reconsideration.

#### DIFFICULTY OF DETERMINING EFFECT OF WOMEN'S EMPLOYMENT.

It is obvious that prolonged and exhaustive medical, statistical, and social research would be necessary before the relative importance of this and the many other enumerated factors related to the infant mortality problem could be accurately known. It would be possible to draw positive conclusions as to the relative importance of this particular factor only by point-to-point comparison of the infant mortality for a period of years in two large communities, or two classes of large communities, in which all the material conditions were substantially common, with the single important exception that in one a considerable proportion of the married female population of child-bearing age were at work outside of their homes and in the other community with which the comparison was made none of the women were so employed.

To admit of entirely sound conclusions, it would be necessary that the populations—and especially the women—of both communities should be of like ages, races, and physical health, that their living

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<sup>a</sup> Fourth Report of the Medical Officer of the Privy Council, pp. 187-196.



conditions should be practically identical, and that, in a general way, the child-bearing women should be of about the same grade of intelligence. Of course no such comparison ever has been or ever will be possible, for the reason that the one exception of the women's work would in various ways make the other conditions of the two communities radically dissimilar. In default of some such comparison on a broad scale of the mortality of the infants of working and non-working women of similar ages, races, intelligence, and living conditions, no one can determine accurately how many of the deaths of working women's infants are due to the mothers' work and how many to the other conditions of their lives and environment.

The nearest approach to definite conclusions which seems to be practicable is that to be obtained by a tabulation of the experience for many years of large and representative communities in which widely varying percentages of married women of child-bearing age are employed in work taking them away from their homes, and by a comparison not only of the average infant death rates for these several communities but of all their social and economic conditions which admit of statistical expression.

All that such a statistical presentation of the subject can accomplish is to point out in the simplest fashion certain facts which may help to serve as guides in determining the part which the extra-domestic employment of married women plays in determining the infant death rate. With this purpose in view the best available facts in regard to American conditions have been brought together in the following pages of this study.

#### INFANT MORTALITY IN NEW ENGLAND STATES IN 1880, 1890, AND 1900.

In any study on a broad basis of the relation of women's work and infant mortality in the United States the six States of New England afford the largest practicable area of investigation. In the first place it would be impracticable to include any except registration States, and no States outside of New England have registration records of births and infant deaths of real value for any considerable number of years. In the second place, in any comparison of vital statistics of the United States, the Negro factor must be eliminated, or at least practically eliminated. The colored death rate at all ages in the registration area of the country is about half again as high as the white death rate at all ages, and in the case of deaths under age 1 the colored rate is more than twice as high as the white rate, as will be shown by this comparison of the white and colored death rates under age 1 per 1,000 births in the census year 1900, according to the Twelfth Census.<sup>a</sup>

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<sup>a</sup> Twelfth Census, Vital Statistics, 1900, Part I, pp. 286-288.

WHITE AND COLORED DEATH RATES UNDER 1 YEAR OF AGE PER 1,000 BIRTHS  
IN 1900.

| Race.        | Registra-<br>tion<br>record. | Registra-<br>tion cities. | Registra-<br>tion<br>States. | Cities in<br>registration<br>States. | Rural part<br>of registra-<br>tion States. |
|--------------|------------------------------|---------------------------|------------------------------|--------------------------------------|--------------------------------------------|
| White.....   | 143.4                        | 154.2                     | 142.0                        | 162.4                                | 107.5                                      |
| Colored..... | 297.0                        | 307.0                     | 282.4                        | 318.9                                | 190.3                                      |

The above comparison makes obvious the impracticability of including in any tabulation of infant mortality rates for the United States any States, cities, or rural districts in which the colored population is of appreciable size. In the case of none of the New England States is the colored population proportionately large enough to act as a disturbing factor in the mortality statistics, the entire Negro population of New England at the time the Twelfth Census was taken aggregating less than 1 per cent of the total population.

In addition to these qualifications as a basis for a broad generalization of the infant mortality experience of this country the compact area embraced in the New England States is a representative region in several particulars of importance in connection with this subject. It is a highly developed manufacturing district, and at least two of its chief industries are those which employ women in large numbers. It thus becomes possible to show the available statistical facts concerning the employment of women in relation to the other statistical facts which have an important bearing upon the infant death rate. It presents a similarity of geographical and climatic conditions, an essential basis of any fair comparison. It is a highly urbanized region. At the same time considerable rural areas are present, which make it possible partially to compare urban and rural conditions. It contains a heavy foreign-born population, thus presenting in that respect a condition typical of those which prevail in many of the industrial sections of the country at large.

#### RELATIVE IMPORTANCE OF MANUFACTURING, AGRICULTURAL, AND OTHER EMPLOYMENTS.

The relative importance of manufacturing, agricultural, and other employments in the various States may be seen from the following table. The table presents for each of the New England States the per cent of the total population 10 years of age and over employed in gainful occupations who were in each main occupation group at each of the last three censuses, 1880, 1890, and 1900.



PER CENT OF TOTAL POPULATION 10 YEARS OF AGE AND OVER IN EACH OF THE MAIN OCCUPATION GROUPS FOR THE NEW ENGLAND STATES, 1880, 1890, AND 1900.

[Figures for the several States are from Twelfth Census, Special Report on Occupations, p. xciv; figures for New England computed from same report, pp. lxxxviii, lxxxix.]

| State.             | Agriculture. |       |       | Professions. |       |       | Domestic and personal service. |       |       | Trade and transportation. |       |       | Manufactures and mechanical pursuits. |       |       |
|--------------------|--------------|-------|-------|--------------|-------|-------|--------------------------------|-------|-------|---------------------------|-------|-------|---------------------------------------|-------|-------|
|                    | 1880.        | 1890. | 1900. | 1880.        | 1890. | 1900. | 1880.                          | 1890. | 1900. | 1880.                     | 1890. | 1900. | 1880.                                 | 1890. | 1900. |
| Maine.....         | 36.0         | 32.0  | 27.8  | 4.4          | 4.8   | 5.0   | 15.5                           | 15.4  | 19.8  | 13.4                      | 14.4  | 15.6  | 30.7                                  | 33.4  | 31.8  |
| New Hampshire..... | 31.7         | 25.7  | 21.7  | 4.6          | 4.1   | 4.3   | 14.6                           | 13.9  | 17.1  | 8.9                       | 12.0  | 14.4  | 40.2                                  | 44.3  | 42.5  |
| Vermont.....       | 46.9         | 41.9  | 36.9  | 4.6          | 4.9   | 5.2   | 18.7                           | 16.7  | 17.1  | 8.1                       | 11.3  | 14.0  | 21.7                                  | 25.2  | 26.8  |
| Massachusetts..... | 9.0          | 7.1   | 5.5   | 3.8          | 4.4   | 5.0   | 19.0                           | 18.2  | 19.1  | 17.0                      | 20.0  | 23.5  | 51.2                                  | 50.3  | 46.9  |
| Rhode Island.....  | 9.4          | 7.5   | 5.7   | 3.2          | 3.5   | 4.1   | 17.2                           | 17.8  | 18.2  | 13.8                      | 17.5  | 19.3  | 56.4                                  | 53.7  | 52.7  |
| Connecticut.....   | 18.3         | 14.4  | 11.6  | 3.7          | 3.9   | 4.4   | 17.3                           | 18.3  | 19.5  | 12.8                      | 15.6  | 18.6  | 47.9                                  | 47.8  | 45.9  |
| Total.....         | 19.4         | 15.2  | 12.1  | 4.0          | 4.3   | 4.8   | 17.6                           | 17.4  | 18.9  | 14.2                      | 17.2  | 20.2  | 44.8                                  | 45.9  | 44.0  |

It will be seen from the foregoing table that in three of the States—Massachusetts, Rhode Island, and Connecticut—approximately one-half of the wage-earners were engaged in manufacturing employments, the per cent so employed in New Hampshire being only slightly less, while in Maine and Vermont the per cent so employed was much smaller. In these two States the per cent in agriculture, on the other hand, was much larger than in the four other States.

#### COMPARISON OF INFANT MORTALITY AND PER CENT FOREIGN-BORN, PER CENT LIVING IN TOWNS, AND PER CENT OF WOMEN IN GAINFUL PURSUITS.

It is possible to make a comparison for these States of conditions as to the percentage of foreign-born in the total population, the per cent of the population living in cities or towns, and the per cent of women 16 years of age and over who are at work as breadwinners. In the following table these facts are presented in comparison with the death rates of children under 1 year per 1,000 births. Before presenting this table it is necessary to make some explanation of the character of the data upon which the figures of the table are based.

The infant death rates for 1900 in the table on page 22 have been compiled from the Twelfth Census, Vital Statistics, Part I, Table 19 (pp. 285-555) in which for the first time in the vital statistics of the census stillbirths were excluded. The figures for 1890 and 1880 have been compiled from the tabular readjustment on that basis of the infant mortality statistics of the Eleventh and Tenth Censuses presented in connection with the analysis of the "Relation of Age to Deaths" of the Eleventh Census, Report on Vital and Social Statistics, Part I, pages 24 and 25. In each case, therefore, stillbirths have been eliminated, and all of the returns in question reduced to a common basis.

It should be borne in mind, however, that Massachusetts was the only one of the New England States whose registration returns were

used in the compilation of the Tenth Census (1880), and the registration returns of Maine were not included in the making up of the Eleventh Census. The above infant mortality records of five of the New England States for the Census year 1880, and of Maine for the census year 1890, are therefore based on the census enumerators' returns, and not on local registration records, and, dating back nearly 30 years as do the earliest of those in question, the hastily gathered enumerators' returns are undoubtedly more or less defective as compared with the figures for 1900, all of which were taken from the local registration records of the six New England States.

Making full allowance for the almost-certain incompleteness of all the 1880 figures in the above tabulation, with the exception of those for Massachusetts, and for the probable defects in the Maine returns for 1890, the figures in question are nevertheless comparable—at least with each other—having been collected in a uniform manner and presumably having approximately the same margin of error.

The Special Report of the Bureau of the Census, issued in 1907 under the title of "Statistics of Women at Work," from which the figures below for women at work are cited is based on information derived from the schedules of the Twelfth Census, 1900. The term "breadwinners" has been applied to persons reported by the census as engaged in gainful occupations, and "applies to every person 10 years of age and over who is at work; that is, occupied in gainful labor during any part of the census year (June 1, 1899, to May 31, 1900, inclusive), or who is ordinarily occupied in remunerative work, but during the census year was unable to secure work of any kind." In the tabulation from which the above figures were quoted, all females between the ages of 10 and 15, inclusive, had been eliminated.

The table follows:

PER CENT OF FOREIGN-BORN OF TOTAL POPULATION, PER CENT OF POPULATION LIVING IN TOWNS OF 4,000 AND MORE INHABITANTS, PER CENT OF FEMALE BREADWINNERS OF TOTAL FEMALE POPULATION OF 16 YEARS AND OVER, AND DEATHS UNDER 1 YEAR PER 1,000 BIRTHS, FOR THE SIX NEW ENGLAND STATES, 1880, 1890, AND 1900.

[Population figures from Eleventh Census, Population, p. lxxx, and Twelfth Census, Population, Part I, p. ciii.]

| State.             | Per cent of foreign-born of total population. |       |       | Per cent of population living in towns of 4,000 and more inhabitants. |       |       | Per cent of women of 16 years and over who are breadwinners. |       |       | Deaths under 1 year per 1,000 births. |       |       |
|--------------------|-----------------------------------------------|-------|-------|-----------------------------------------------------------------------|-------|-------|--------------------------------------------------------------|-------|-------|---------------------------------------|-------|-------|
|                    | 1880.                                         | 1890. | 1900. | 1880.                                                                 | 1890. | 1900. | 1880.                                                        | 1890. | 1900. | 1880.                                 | 1890. | 1900. |
| Maine.....         | 9.1                                           | 11.9  | 13.4  | 20.9                                                                  | 34.2  | 36.2  | 14.3                                                         | 18.6  | 20.5  | 67.8                                  | 95.6  | 132.2 |
| New Hampshire..... | 13.3                                          | 19.2  | 21.4  | 26.3                                                                  | 37.6  | 46.7  | 22.2                                                         | 24.9  | 26.6  | 89.8                                  | 153.7 | 156.0 |
| Vermont.....       | 12.3                                          | 13.3  | 13.0  | 11.4                                                                  | 12.1  | 21.0  | 13.4                                                         | 16.3  | 18.4  | 81.9                                  | 103.3 | 111.9 |
| Massachusetts..... | 24.9                                          | 29.4  | 30.2  | 65.9                                                                  | 83.0  | 86.9  | 25.2                                                         | 30.2  | 30.3  | 142.5                                 | 182.6 | 160.0 |
| Rhode Island.....  | 26.8                                          | 30.8  | 31.4  | 77.2                                                                  | 89.8  | 91.6  | 27.0                                                         | 30.0  | 31.4  | 107.7                                 | 192.7 | 177.0 |
| Connecticut.....   | 20.9                                          | 24.6  | 26.2  | 53.9                                                                  | 64.7  | 65.5  | 20.3                                                         | 24.9  | 26.2  | 100.3                                 | 147.8 | 142.5 |
| Total.....         | 19.8                                          | 24.3  | 25.8  | 49.6                                                                  | 65.1  | 70.5  | 21.7                                                         | 26.4  | 27.8  | 113.3                                 | 160.0 | 152.3 |

An examination of the foregoing table indicates that some relationship exists between the various tabulated items. It will be noted that for the last two census years Rhode Island shows the highest rate of infant mortality of any State in the New England group. At the census of 1880 it showed the second highest rate. When its rank in respect to the proportion of females of 16 years and over gainfully employed is noted, it again is found to rank first in the years 1880 and 1900, and second in 1890. If we were to go no further, it would be easy to conclude that here is a causal relation. But it is seen that the State ranks first for all three census years in the proportion of foreign-born to total population. It also ranks first for all three census years in the proportion of its population living in cities of 4,000 or more inhabitants, and in the natural correlative of this high degree of urbanization, namely, the proportion of its population engaged in manufactures.

An examination of any of those States which rank low in regard to infant mortality shows the opposite situation. Vermont has the lowest rate for 1900, and ranks fifth in the two preceding censuses. In the census of 1900 it was sixth in respect to proportion of foreign-born, and fifth in 1890 and 1880. It is sixth for all three censuses in degree of urbanization of its population and in the proportion of women gainfully employed. It is, as would be expected from these factors, first as regards the proportion of its population employed in agriculture, and sixth in the proportion engaged in manufactures. Detailed comparisons for each State, while there are occasional variations and irregularities, show the same general relationship. It may be said that the most significant relationship is shown by the census of 1900, for the reason that that census was more comprehensive and reliable than the preceding censuses, and for the first time the registration records of all of the New England States were used in the Twelfth Census, though in the preceding census (1890), with the single exception of Maine, all of these States were recognized as registration States.

It may be here noted that one factor of significance in relation to the infant death rate in these States has of necessity been omitted from consideration in this table, namely, the birth rate. Existing data, except as considered later for the State of Massachusetts alone, are so unsatisfactory as to be misleading.

#### PER CENT OF MARRIED WOMEN IN GAINFUL PURSUITS.

As regards the figures for women at work, the clearly significant thing is not simply the proportion of women at work in gainful pursuits, but the proportion of married women between 15 and 45 years of age engaged in those occupations which take them out of their own homes. Indeed, perfect accuracy would demand that data for



mothers of children under 1 year only, occupied outside of their homes, should be considered.

The detailed figures of ages and marital condition by States are not given, however, in the special report of the Bureau of the Census, with the single exception of the number of female breadwinners by States and age groups in 1900, which, by showing that 476,883 of the 561,235 female breadwinners of New England were between ages 16 and 44, thereby indicate that 85 per cent of all the females of 16 years and over engaged in gainful occupations in New England in the census year 1900 were of child-bearing age. Presumably the age percentage in the case of women of 16 years and over employed in gainful occupations in the census years 1890 and 1880 was not materially different from that of 1900, and the above tabular summary of working women in the three census years in question would therefore seem to be fairly comparable with a similar tabulation of the infant death rates in the States in question. But as to the vital issue, the extra-domestic employment of the mothers of families, these general figures for women breadwinners serve only as the crudest possible indication of the number so employed. All that it is possible to say is that probably, in the absence of prohibitive legislation, those States where women-employing industries prevail are likely to have a rather large proportion of married women at work.

It can not be said, however, that even this probability is borne out by the meager statistics available on the subject. The Twelfth Census presents figures showing the number and per cent of married women gainfully employed in the census years 1890 and 1900, in comparison to the total number of married women in the population, but such figures are not available for the census of 1880. The figures for 1890 and 1900 are presented in the table following:

NUMBER AND PER CENT OF MARRIED WOMEN ENGAGED IN GAINFUL PURSUITS, COMPARED TO TOTAL NUMBER OF MARRIED WOMEN IN THE POPULATION OF THE NEW ENGLAND STATES.

[From Twelfth Census, Special Report on Occupations, 1900, p. ccxxiii.]

| State.             | Married women employed in gainful pursuits. |        |                                                |       |
|--------------------|---------------------------------------------|--------|------------------------------------------------|-------|
|                    | Number.                                     |        | Per cent of total married women in population. |       |
|                    | 1890.                                       | 1900.  | 1890.                                          | 1900. |
| Maine.....         | 5,770                                       | 7,991  | 4.2                                            | 5.6   |
| New Hampshire..... | 5,941                                       | 7,783  | 7.6                                            | 9.2   |
| Vermont.....       | 2,276                                       | 3,298  | 3.3                                            | 4.5   |
| Massachusetts..... | 27,145                                      | 38,555 | 6.4                                            | 7.3   |
| Rhode Island.....  | 4,211                                       | 5,505  | 6.5                                            | 6.9   |
| Connecticut.....   | 5,690                                       | 8,686  | 4.0                                            | 5.0   |
| Total.....         | 51,033                                      | 71,818 | 5.6                                            | 6.7   |



The above table shows that for New England as a whole, or even for single States, the per cent of married women who are gainfully employed is small, in 1900 being less than 7 per cent for all New England and only 6.9 and 7.3 per cent in Rhode Island and Massachusetts, respectively, the States which are most important industrially. These per cents, however, probably do not fully indicate the relative importance of the employment of married women of child-bearing age, as the proportion of women of child-bearing age would be greater among the wage-earning married women than in the nonwage-earning married women of the population.<sup>a</sup>

But though the percentages of the foregoing table may fall short of representing the importance of the employment of married women of child-bearing age, they are misleading if taken as an accurate measure of the effect of such employment upon the infant mortality rate. Here, it will be obvious, the point of real significance as directly affecting infant mortality is the extent of employment outside the home of married women who are mothers of children under 1 year.<sup>b</sup>

#### CONCLUSIONS FROM NEW ENGLAND STATISTICS.

It will be seen at once that definite conclusions as to the effect of any single influence upon the infant mortality rate can not be drawn from the foregoing tables. If the infant mortality rates were compared with any one item, a causal relationship would almost certainly be assumed. There is a striking correspondence between that rate and each of the important items in the tables. It may be said that until quite recently the accuracy of the statement that infant mortality and the employment of married women are intimately related has usually been maintained upon the ground of such isolated comparisons, and other data bearing upon the situation have been given but small consideration.

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<sup>a</sup> Out of 4,150 married, widowed, divorced, and separated women employed in the New England cotton mills investigated by the Bureau of Labor in 1908, whose ages were reported, 85.9 per cent were under 45 years of age; see *Cotton Textile Industry*, Vol. I of this report, page 637.

<sup>b</sup> In Massachusetts, for example, of the 7,535 women 16 years of age and over employed in 22 representative cotton mills studied by the agents of the Bureau of Labor 29.6 per cent were married and 4 per cent widowed, divorced, or separated. Out of 407 married, widowed, divorced, and separated women (including wage earners and nonwage earners) living in the Massachusetts cotton mill families visited in the course of the same investigation, only 101 were at work as wage earners at the time of the agents' visits, and of these only 13, or 12.9 per cent, were mothers of children under 3 years of age. As compared with the total of 407 married, widowed, divorced, and separated women in this limited number of representative cotton mill families, this is only 3.2 per cent, and it may be fairly assumed that the per cent of women at work at any one time who were the mothers of children under 1 year would be less than one-third of this number, or not over 1 per cent. As compared with the total number of married, widowed, divorced, and separated women in the total population of the State the proportion would evidently be even smaller.

At best, however, comparisons of mortality statistics on any such broad basis as that of entire States are unsatisfactory and may be extremely misleading. There is certain to be a great variety of differential factors involved in the case of the States whose rates are compared and the previous study of the apparent relationship of women's work, and infant mortality in the New England States in the last three census years, therefore, is valuable chiefly as a preliminary to a more detailed study.

#### INFANT MORTALITY IN MASSACHUSETTS CITIES.

For the reasons already pointed out on a previous page, the State of Massachusetts offers by far the best field in the United States for a careful study of the subject of infant mortality and woman's employment.

Aside from its comprehensive system of recording both vital and industrial statistics, its greatest industries are those which employ many women, namely, the manufacture of textiles, and of boots and shoes. It may also be said to be the best American example of a highly organized industrial district, and it therefore may be said to be not only representative of conditions for the industrial sections of the United States, but is an index of the conditions which are becoming increasingly predominant in this country.

#### CHARACTER OF STATISTICS AVAILABLE.

The main sources of statistical information on infantile mortality and its related factors for Massachusetts are the reports of births, marriages, and deaths in Massachusetts, which have been issued annually for about seventy years, the annual reports of the State board of health, and the State censuses, which are issued every five years by the Massachusetts Bureau of Statistics.

The Twenty-eighth Annual Report of the State Board of Health of Massachusetts, published in 1897, included a tabulation of "Infant mortality of cities, ten years, 1881-1890." This table stated the aggregate numbers of births and deaths under age 1 and the infant death rates for this ten-year period for each of the 32 cities in the State at the period in question.

The fourth and sixth decennial state censuses supply detailed figures as to the nativity, conjugal condition, occupations, etc., of the populations for each of the 32 cities in question in the years 1885 and 1905, and with this information it is possible to compile a comparison for two ten-year periods of the infant death rates with the number of women employed and with the other important related factors which admit of statistical presentation in these cities.

Certain points in this table which are fundamental to the discussion of the greater part of this study demand explanation. The table gives the birth rate per 1,000 total population for the two

decades under consideration, namely, 1881-1890, and 1898-1907. The inaccuracy of this tabulated birth rate must be admitted. This arises from two main causes. In the first place, the registration of births, even in Massachusetts, is not complete, and was more defective in the earlier years, for which data are here presented. In the words of Dr. Francis A. Harris, who edited the sixty-seventh report of the births, marriages, and deaths in Massachusetts, for the year 1908—

Although the law applies to the registration of births, as well as to that of marriages and deaths, it is probable that the statistics of the births are less accurate than those of either of the other two classes. From the nature of things, marriages and deaths must be registered in order that the former may be solemnized or that interment be possible in case of deaths; but in the case of the births the inadequacy of penalty for neglect, ignorance of the law, as well as topographical conditions, tend to an incomplete registration. It is therefore likely that the number of births returned in Massachusetts in 1908 was less than the actual number which occurred, hence a lower birth rate, and comparisons between births and deaths inaccurate.

This inaccuracy was undoubtedly greater in the earlier years under consideration in this study.

But there is a further difficulty in computing the birth rate. What is generally known as the crude annual birth rate of a community is found by dividing the total number of births in that community by its total population. This method of computation is somewhat unsatisfactory for purposes of comparison, owing to the differing composition of various populations; but this matter is beyond the province of this study. Assuming that the crude rate is a reasonably safe basis for the present comparison, in order to find the average crude birth rate for each of the 32 cities in the following table for a decade, the proper method would be to divide the sum of the births for the decade by the sum of the annual populations for the same decade.

But no accurate figures are available as to the population of each city for each of the twenty years embraced in this study. The best that can be done is to divide the total number of births in each city during the two decades by the population of the city at the census year, which will afford the nearest approach to a mean population for each of the two decades. For this purpose the two Massachusetts censuses of 1885 and 1905 have been used. It is true that the census of 1905 does not fall at the middle of the decade for which it has been used as a basis of calculation, but no better population data were available, the Twelfth Census, 1900, being no better than that of Massachusetts for this purpose. The rate secured by this division, being divided by 10, gives some approximation to an average annual birth rate for each decade. The method being the same for all 32



cities, it does not interfere seriously with comparisons between them; and admitting a considerable margin of error in registration these birth rates have a certain comparative value.

As a result of the incomplete registration of births, not only is the birth rate itself rendered inaccurate, but the infant mortality rate is also affected in some degree. As already explained (p. 12), the generally accepted infant death rate is not the rate as measured by the living population under age 1, but is the ratio of infant deaths to births.

### COMPARISON OF INFANT MORTALITY, PER CENT OF POPULATION FOREIGN-BORN, AND BIRTH RATE.

The following table shows for the two periods the total population, the per cent of foreign-born in the population, the birth rate per 1,000 of the total population, and the death rate under 1 year per 1,000 births, for each of the 32 cities of the State:

BIRTH RATE PER 1,000 OF TOTAL POPULATION, DEATH RATE UNDER 1 YEAR OF AGE PER 1,000 BIRTHS, AGGREGATE POPULATION, AND PER CENT OF FOREIGN BORN IN 32 MASSACHUSETTS CITIES, 1885 AND 1905.

| City.            | Total population.  |                    | Per cent of foreign-born of total population. |                    | Births per 1,000 total population. |                         | Deaths under 1 year per 1,000 births. |            |
|------------------|--------------------|--------------------|-----------------------------------------------|--------------------|------------------------------------|-------------------------|---------------------------------------|------------|
|                  | 1885. <sup>a</sup> | 1905. <sup>b</sup> | 1885. <sup>a</sup>                            | 1905. <sup>b</sup> | 1881-1890. <sup>c</sup>            | 1898-1907. <sup>d</sup> | 1881-1890.                            | 1898-1907. |
| Beverly.....     | 9,186              | 15,223             | 14.73                                         | 23.56              | 19.8                               | 20.3                    | 118.9                                 | 108.6      |
| Boston.....      | 390,393            | 595,380            | 34.14                                         | 35.23              | 30.1                               | 27.3                    | 188.2                                 | 144.0      |
| Brockton.....    | 20,783             | 47,794             | 19.40                                         | 25.68              | 23.6                               | 21.2                    | 146.9                                 | 109.5      |
| Cambridge.....   | 59,658             | 97,434             | 32.16                                         | 32.70              | 28.9                               | 26.5                    | 172.3                                 | 130.1      |
| Chelsea.....     | 25,709             | 37,289             | 25.60                                         | 37.23              | 25.1                               | 28.2                    | 166.9                                 | 133.2      |
| Chicopee.....    | 11,516             | 20,191             | 39.79                                         | 39.21              | 31.1                               | 37.6                    | 176.1                                 | 178.4      |
| Everett.....     | 5,825              | 29,111             | 20.86                                         | 28.60              | 33.6                               | 26.0                    | 131.9                                 | 121.5      |
| Fall River.....  | 56,870             | 105,762            | 49.16                                         | 43.86              | 32.6                               | 41.1                    | 239.7                                 | 194.2      |
| Fitchburg.....   | 15,375             | 33,021             | 23.98                                         | 34.82              | 31.2                               | 29.6                    | 134.3                                 | 137.4      |
| Gloucester.....  | 21,703             | 26,011             | 32.32                                         | 32.93              | 26.4                               | 23.7                    | 138.8                                 | 135.2      |
| Haverhill.....   | 21,795             | 37,830             | 19.09                                         | 23.42              | 26.4                               | 23.6                    | 157.1                                 | 121.1      |
| Holyoke.....     | 27,895             | 49,934             | 49.79                                         | 39.59              | 42.1                               | 31.6                    | 168.1                                 | 187.8      |
| Lawrence.....    | 38,862             | 70,050             | 43.94                                         | 46.08              | 30.2                               | 30.1                    | 213.9                                 | 181.2      |
| Lowell.....      | 64,107             | 94,889             | 40.37                                         | 41.73              | 29.1                               | 26.9                    | 222.5                                 | 208.2      |
| Lynn.....        | 45,867             | 77,042             | 21.30                                         | 28.52              | 25.8                               | 21.8                    | 140.7                                 | 133.0      |
| Malden.....      | 16,407             | 38,037             | 26.41                                         | 28.91              | 28.9                               | 22.1                    | 133.4                                 | 129.3      |
| Marlboro.....    | 10,941             | 14,073             | 26.17                                         | 23.39              | 30.7                               | 21.3                    | 154.6                                 | 124.0      |
| Medford.....     | 9,042              | 19,686             | 23.38                                         | 22.75              | 22.4                               | 22.1                    | 130.9                                 | 101.5      |
| New Bedford..... | 33,393             | 74,362             | 30.71                                         | 42.70              | 28.9                               | 34.0                    | 177.7                                 | 172.2      |
| Newburyport..... | 13,716             | 14,675             | 19.00                                         | 19.01              | 22.9                               | 21.1                    | 152.7                                 | 111.3      |
| Newton.....      | 19,759             | 36,827             | 27.81                                         | 29.07              | 22.1                               | 21.2                    | 111.9                                 | 112.8      |
| North Adams..... | 12,540             | 22,150             | 27.04                                         | 28.14              | 42.3                               | 28.9                    | 115.1                                 | 121.5      |
| Northampton..... | 12,896             | 19,957             | 26.01                                         | 24.76              | 23.4                               | 21.4                    | 135.7                                 | 122.4      |
| Pittsfield.....  | 14,466             | 25,001             | 23.32                                         | 20.46              | 24.6                               | 22.7                    | 144.8                                 | 108.5      |
| Quincy.....      | 12,145             | 28,076             | 30.34                                         | 34.26              | 34.9                               | 27.3                    | 124.0                                 | 111.9      |
| Salem.....       | 28,090             | 37,627             | 27.06                                         | 29.56              | 24.9                               | 27.1                    | 180.6                                 | 166.5      |
| Somerville.....  | 29,971             | 69,272             | 25.02                                         | 27.92              | 26.3                               | 23.7                    | 154.3                                 | 107.2      |
| Springfield..... | 37,575             | 73,540             | 23.79                                         | 25.21              | 27.3                               | 22.6                    | 157.3                                 | 125.4      |
| Taunton.....     | 23,674             | 30,967             | 27.75                                         | 28.67              | 27.8                               | 26.1                    | 140.5                                 | 156.8      |
| Waltham.....     | 14,609             | 26,282             | 27.47                                         | 28.23              | 25.1                               | 19.5                    | 131.7                                 | 103.1      |
| Woburn.....      | 11,750             | 14,402             | 30.00                                         | 26.53              | 32.1                               | 23.2                    | 127.0                                 | 145.7      |
| Worcester.....   | 68,389             | 128,135            | 29.51                                         | 32.38              | 31.0                               | 26.7                    | 155.6                                 | 137.1      |
| Total.....       | 1,184,907          | 2,010,030          | 32.02                                         | 34.18              | 29.2                               | 27.1                    | 174.9                                 | 148.1      |
| The State.....   | 1,942,141          | 3,003,680          | 27.13                                         | 30.56              | 26.2                               | 25.0                    | 160.4                                 | 141.7      |

<sup>a</sup> From Census of Massachusetts, 1885, Vol. I, Part 1.

<sup>b</sup> From Census of Massachusetts, 1905, Vol. I.

<sup>c</sup> Average annual birth rate computed by dividing total number of births, 1881-1890, by ten times population at Census of Massachusetts, 1885.

<sup>d</sup> Average annual birth rate computed by dividing total number of births, 1898-1907, by ten times population at Census of Massachusetts, 1905.



## DECREASE IN INFANT MORTALITY.

Probably the first feature of the foregoing table to attract attention will be the decided decrease in the infant mortality rates for the State of Massachusetts and its 32 cities, the decrease for the State having been from an infant death rate of 160.4 per 1,000 births in the former decade to one of 141.7 in the latter ten-year period, and a corresponding decline in the case of the 32 cities from 174.9 to 148.1. Against the State's decrease of 18.7 in the infant death rate per 1,000 births, the 32 cities scored an even more marked decrease of 26.8 infant deaths per 1,000 births. In the case of the cities the decrease amounted to 15.3 per cent; in the case of the State, to but 11.7 per cent.

Before accepting this decrease at its apparent face value, two facts must be borne in mind: First, that improved methods of registration of vital statistics tend to bring the annual registrations of births closer to the actual number of births, and secondly, the fact that it was not until 1880 that the general court of Massachusetts ordained that births should be reported by physicians and midwives. Up to that time, even in Massachusetts, there was no such statutory requirement, and it is certain that as the years wore on the new law steadily came to be more generally observed. That would mean an increased percentage of birth registrations, and by the consequent increase of the divisor (the number of births) a slow but sure decrease in the quotient of the division (the rate of infant deaths per 1,000 births). That there has been a decrease in infant mortality in Massachusetts in the last twenty years, there can be little doubt; it is a question, however, how far the material improvement of late years in the registration of births is responsible for the seeming material decrease shown in the preceding table.<sup>a</sup>

## PER CENT OF WOMEN GAINFULLY EMPLOYED AND PER CENT ILLITERATE, MARRIED, AND OF CHILD-BEARING AGE.

It would be desirable to classify by age groups the working female population of the places under investigation for the purpose of analyzing so far as possible the probable causes of their high or low infant mortality. In the case of the large number of cities included in the tables accompanying this article, however, and the great variety of occupations involved, the material for such a classification was not obtainable without an investigation for that especial purpose.

A great variety of conditions may affect the percentage of married women and the average age of the female population in any city. The nature of the principal occupation of the female population in any industrial town is by no means the only factor. Thus 20.3 per

<sup>a</sup> The number of births and deaths for each of the 32 cities studied, for each of the ten years embraced in the second decade considered in the foregoing table, will be found in the Appendix (p. 56 et seq.).

cent of the female cotton-mill operatives of 16 years and over in the United States in 1900 were married,<sup>a</sup> thereby taking the lead of all factory employments in which large numbers of women are engaged. And yet, even in a city so preeminently a cotton-mill town as Fall River, in which nearly one-third the entire female population of 10 years and over in 1905 was at work in the cotton mills, the percentage of married women in that year was considerably lower than in many other large manufacturing towns of Massachusetts.

A comparison of the figures of the following table will show that in the main the percentages of married, widowed, and divorced women, and of women of child-bearing age held very uniform in 1885 and 1905 in most of the Massachusetts cities. The general uniformity is shown by the fact that in the 32 cities in question the ratio of married, widowed, and divorced women to the total female population of 10 years and over was 54.8 per cent in 1905, as compared with 54.9 per cent in 1885, and that the respective percentages for the State at large in these same years were 55.8 and 56.6. The same might be said of the ratios of women between ages 14 and 45, inclusive, the percentages for the 32 cities in 1905 and 1885, respectively, having been 55.7 and 56.6, and for the State at large 54.4 and 54.3.

These figures, therefore, while presented along with the other data under consideration, have little comparative significance, especially in view of the fact that it is impossible to say what proportion of either class are industrially employed.

NUMBER AND PER CENT OF FEMALES 10 YEARS OF AGE AND OVER IN 32 CITIES IN MASSACHUSETTS ENGAGED IN GAINFUL OCCUPATIONS AND NUMBER AND PER CENT OF ILLITERATES AND OF MARRIED, WIDOWED, OR DIVORCED WOMEN, WITH TOTAL FEMALE POPULATION AND NUMBER AND PER CENT OF FEMALES 14 TO 45 YEARS OF AGE, INCLUSIVE, 1885 AND 1905.

[Compiled from Census of Massachusetts, 1885 and 1905.]

1885.

| Cities.         | Female population 10 years of age and over. |                                                                |           |              |           |                                | Total female population. | Women of ages 14 to 45, inclusive. |                                      |      |
|-----------------|---------------------------------------------|----------------------------------------------------------------|-----------|--------------|-----------|--------------------------------|--------------------------|------------------------------------|--------------------------------------|------|
|                 | Total.                                      | Engaged in gainful occupations, domestic service not included. |           | Illiterates. |           | Married, widowed, or divorced. |                          | Number.                            | Per cent of total female population. |      |
|                 |                                             | Number.                                                        | Per cent. | Number.      | Per cent. | Number.                        | Per cent.                |                                    |                                      |      |
| Beverly.....    | 4,094                                       | 650                                                            | 15.9      | 138          | 3.37      | 2,319                          | 56.6                     | 4,837                              | 2,640                                | 54.6 |
| Boston.....     | 168,975                                     | 29,103                                                         | 17.2      | 16,129       | 9.55      | 90,800                         | 53.7                     | 204,211                            | 117,960                              | 57.8 |
| Brockton.....   | 8,459                                       | 1,593                                                          | 18.8      | 342          | 4.04      | 5,288                          | 62.5                     | 10,385                             | 6,059                                | 58.3 |
| Cambridge.....  | 25,049                                      | 3,818                                                          | 15.2      | 2,400        | 9.58      | 13,691                         | 54.7                     | 31,049                             | 17,121                               | 55.1 |
| Chelsea.....    | 11,200                                      | 1,415                                                          | 12.6      | 339          | 3.03      | 6,499                          | 58.0                     | 13,570                             | 7,565                                | 55.7 |
| Chicopee.....   | 5,086                                       | 1,654                                                          | 32.5      | 1,087        | 21.37     | 2,688                          | 52.9                     | 6,159                              | 3,415                                | 55.4 |
| Everett.....    | 2,411                                       | 226                                                            | 9.4       | 60           | 2.49      | 1,404                          | 62.0                     | 2,944                              | 1,598                                | 54.3 |
| Fall River..... | 23,723                                      | 8,776                                                          | 37.0      | 5,915        | 24.93     | 12,631                         | 53.2                     | 30,063                             | 16,949                               | 56.4 |
| Fitchburg.....  | 6,343                                       | 1,114                                                          | 17.6      | 608          | 9.59      | 3,718                          | 58.6                     | 7,873                              | 4,248                                | 54.0 |
| Gloucester..... | 7,890                                       | 676                                                            | 8.6       | 563          | 7.14      | 4,726                          | 59.9                     | 9,980                              | 5,291                                | 53.0 |
| Haverhill.....  | 9,336                                       | 2,161                                                          | 23.1      | 573          | 6.14      | 5,697                          | 61.0                     | 11,340                             | 6,433                                | 56.7 |

<sup>a</sup> Bureau of the Census, Statistics of Women at Work, p. 38.

NUMBER AND PER CENT OF FEMALES 10 YEARS OF AGE AND OVER IN 32 CITIES IN MASSACHUSETTS ENGAGED IN GAINFUL OCCUPATIONS AND NUMBER AND PER CENT OF ILLITERATES AND OF MARRIED, WIDOWED, OR DIVORCED WOMEN, WITH TOTAL FEMALE POPULATION AND NUMBER AND PER CENT OF FEMALES 14 TO 45 YEARS OF AGE, INCLUSIVE, 1885 AND 1905—Concluded.

1885—Concluded.

| Cities.          | Female population 10 years of age and over. |                                                                |           |              |           |                                |           | Total female population. | Women of ages 14 to 45, inclusive. |                                      |
|------------------|---------------------------------------------|----------------------------------------------------------------|-----------|--------------|-----------|--------------------------------|-----------|--------------------------|------------------------------------|--------------------------------------|
|                  | Total.                                      | Engaged in gainful occupations, domestic service not included. |           | Illiterates. |           | Married, widowed, or divorced. |           |                          | Num-ber.                           | Per cent of total female population. |
|                  |                                             | Num-ber.                                                       | Per cent. | Num-ber.     | Per cent. | Num-ber.                       | Per cent. |                          |                                    |                                      |
| Holyoke.....     | 11,598                                      | 4,328                                                          | 37.3      | 2,193        | 18.91     | 5,862                          | 50.5      | 14,677                   | 8,694                              | 59.0                                 |
| Lawrence.....    | 17,411                                      | 6,045                                                          | 34.7      | 2,143        | 12.31     | 9,095                          | 52.2      | 21,156                   | 12,277                             | 58.2                                 |
| Lowell.....      | 29,916                                      | 11,275                                                         | 37.7      | 3,853        | 12.88     | 15,408                         | 51.5      | 35,590                   | 21,154                             | 59.4                                 |
| Lynn.....        | 20,140                                      | 4,982                                                          | 24.7      | 1,076        | 5.34      | 11,866                         | 58.9      | 24,115                   | 13,976                             | 58.0                                 |
| Malden.....      | 7,293                                       | 1,288                                                          | 17.7      | 309          | 4.24      | 4,079                          | 55.9      | 8,717                    | 5,052                              | 58.0                                 |
| Marlboro.....    | 4,280                                       | 944                                                            | 22.1      | 571          | 13.34     | 2,407                          | 56.2      | 5,374                    | 2,900                              | 54.0                                 |
| Medford.....     | 3,805                                       | 433                                                            | 11.4      | 212          | 5.57      | 2,114                          | 55.6      | 4,624                    | 2,525                              | 54.6                                 |
| New Bedford..... | 14,982                                      | 3,400                                                          | 22.8      | 2,164        | 14.44     | 8,692                          | 58.0      | 17,980                   | 9,815                              | 54.6                                 |
| Newburyport..... | 6,401                                       | 1,255                                                          | 19.6      | 693          | 10.83     | 3,631                          | 56.7      | 7,554                    | 3,728                              | 49.4                                 |
| Newton.....      | 9,263                                       | 996                                                            | 10.8      | 677          | 7.31      | 4,438                          | 47.9      | 11,018                   | 6,402                              | 58.1                                 |
| North Adams..... | 5,173                                       | 1,158                                                          | 22.4      | 501          | 9.68      | 2,897                          | 56.0      | 6,481                    | 3,617                              | 55.8                                 |
| Northampton..... | 5,977                                       | 1,126                                                          | 18.8      | 550          | 9.20      | 2,993                          | 50.1      | 7,044                    | 3,941                              | 55.9                                 |
| Pittsfield.....  | 6,140                                       | 1,200                                                          | 19.5      | 351          | 5.72      | 3,231                          | 52.6      | 7,596                    | 4,100                              | 54.0                                 |
| Quincy.....      | 4,678                                       | 395                                                            | 8.4       | 332          | 7.10      | 2,754                          | 58.9      | 5,953                    | 3,154                              | 53.0                                 |
| Salem.....       | 12,791                                      | 2,468                                                          | 19.3      | 1,185        | 9.26      | 6,748                          | 52.8      | 15,315                   | 8,196                              | 53.5                                 |
| Somerville.....  | 12,754                                      | 1,474                                                          | 11.6      | 754          | 5.91      | 7,407                          | 58.1      | 15,781                   | 8,806                              | 55.1                                 |
| Springfield..... | 16,359                                      | 2,749                                                          | 16.8      | 1,429        | 8.74      | 9,514                          | 58.2      | 19,698                   | 10,996                             | 55.8                                 |
| Taunton.....     | 10,099                                      | 1,873                                                          | 18.5      | 913          | 9.04      | 5,708                          | 56.5      | 12,146                   | 6,605                              | 54.4                                 |
| Waltham.....     | 6,639                                       | 1,734                                                          | 26.1      | 521          | 7.85      | 3,427                          | 51.6      | 7,901                    | 4,607                              | 58.3                                 |
| Woburn.....      | 4,595                                       | 582                                                            | 12.7      | 492          | 10.71     | 2,706                          | 58.9      | 5,848                    | 2,963                              | 50.7                                 |
| Worcester.....   | 27,794                                      | 4,083                                                          | 14.7      | 2,417        | 8.70      | 15,906                         | 57.2      | 34,707                   | 19,019                             | 54.8                                 |
| Total.....       | 510,654                                     | 104,983                                                        | 20.6      | 51,490       | 10.08     | 280,434                        | 54.9      | 621,686                  | 351,806                            | 56.6                                 |
| The State.....   | 830,214                                     | 152,161                                                        | 18.3      | 76,713       | 9.24      | 470,206                        | 56.6      | 1,009,257                | 547,811                            | 54.3                                 |

1905.

|                  |           |         |      |        |       |         |      |           |         |      |
|------------------|-----------|---------|------|--------|-------|---------|------|-----------|---------|------|
| Beverly.....     | 6,474     | 1,150   | 17.9 | 138    | 2.13  | 3,781   | 58.4 | 7,673     | 4,063   | 53.0 |
| Boston.....      | 252,157   | 59,861  | 23.7 | 13,666 | 5.42  | 134,208 | 53.2 | 305,071   | 173,874 | 57.0 |
| Brookton.....    | 20,078    | 5,376   | 26.8 | 591    | 2.94  | 12,202  | 60.8 | 24,220    | 13,813  | 57.0 |
| Cambridge.....   | 41,141    | 9,673   | 23.5 | 1,718  | 4.18  | 21,890  | 53.2 | 50,203    | 27,005  | 55.4 |
| Chelsea.....     | 14,909    | 3,117   | 20.9 | 896    | 6.01  | 8,677   | 58.2 | 18,740    | 10,811  | 58.4 |
| Chicopee.....    | 7,869     | 2,536   | 32.2 | 802    | 10.19 | 4,382   | 55.7 | 10,101    | 5,556   | 55.0 |
| Everett.....     | 12,037    | 2,319   | 19.3 | 245    | 2.04  | 7,396   | 61.4 | 14,941    | 8,172   | 54.7 |
| Fall River.....  | 43,586    | 16,839  | 38.6 | 6,582  | 15.10 | 23,291  | 53.4 | 55,375    | 30,278  | 54.7 |
| Fitchburg.....   | 13,495    | 3,416   | 25.3 | 718    | 5.32  | 7,521   | 55.7 | 16,791    | 9,013   | 53.7 |
| Gloucester.....  | 10,059    | 1,522   | 15.1 | 573    | 5.70  | 6,044   | 60.1 | 12,410    | 6,419   | 51.8 |
| Haverhill.....   | 16,501    | 4,331   | 26.3 | 594    | 3.60  | 9,805   | 59.4 | 19,805    | 10,716  | 54.1 |
| Holyoke.....     | 20,913    | 7,126   | 34.1 | 1,847  | 8.83  | 10,506  | 50.2 | 26,165    | 14,936  | 57.1 |
| Lawrence.....    | 28,933    | 10,665  | 36.9 | 3,034  | 10.49 | 15,716  | 54.3 | 35,986    | 20,346  | 56.5 |
| Lowell.....      | 41,598    | 15,215  | 36.6 | 2,913  | 7.00  | 21,721  | 52.2 | 50,019    | 28,784  | 57.5 |
| Lynn.....        | 32,759    | 9,384   | 28.6 | 707    | 2.16  | 19,656  | 60.0 | 38,916    | 21,955  | 56.4 |
| Malden.....      | 16,030    | 3,085   | 21.8 | 594    | 3.51  | 9,430   | 55.7 | 20,457    | 11,281  | 55.1 |
| Marlboro.....    | 6,078     | 1,604   | 27.9 | 245    | 4.03  | 3,299   | 54.3 | 7,277     | 3,899   | 53.6 |
| Medford.....     | 8,560     | 1,412   | 16.5 | 130    | 1.52  | 4,968   | 58.0 | 10,343    | 4,670   | 45.2 |
| New Bedford..... | 31,426    | 9,943   | 31.6 | 3,888  | 12.37 | 17,944  | 57.1 | 38,631    | 21,398  | 55.4 |
| Newburyport..... | 6,635     | 1,498   | 22.6 | 292    | 4.40  | 3,775   | 56.9 | 7,793     | 3,860   | 49.5 |
| Newton.....      | 17,515    | 2,822   | 16.1 | 438    | 2.50  | 8,466   | 48.3 | 20,658    | 11,827  | 57.3 |
| North Adams..... | 9,207     | 2,551   | 27.7 | 628    | 6.82  | 5,154   | 56.0 | 11,501    | 6,266   | 54.5 |
| Northampton..... | 9,590     | 2,243   | 23.1 | 707    | 7.37  | 4,380   | 45.7 | 11,221    | 6,570   | 58.6 |
| Pittsfield.....  | 10,840    | 2,696   | 24.9 | 420    | 3.87  | 5,826   | 53.7 | 12,926    | 7,268   | 56.2 |
| Quincy.....      | 10,830    | 1,640   | 15.1 | 331    | 3.06  | 6,230   | 57.5 | 13,654    | 7,324   | 53.6 |
| Salem.....       | 16,154    | 3,912   | 24.2 | 797    | 4.93  | 8,661   | 53.6 | 19,788    | 10,331  | 52.2 |
| Somerville.....  | 30,083    | 5,831   | 19.4 | 750    | 2.49  | 17,862  | 59.4 | 36,514    | 19,875  | 54.4 |
| Springfield..... | 32,021    | 7,294   | 22.8 | 1,438  | 4.49  | 18,143  | 56.7 | 38,202    | 21,455  | 56.2 |
| Taunton.....     | 13,066    | 2,925   | 22.4 | 1,007  | 7.71  | 7,272   | 55.7 | 15,922    | 8,303   | 52.1 |
| Waltham.....     | 12,264    | 3,860   | 31.5 | 684    | 5.58  | 5,947   | 48.5 | 14,263    | 8,394   | 58.9 |
| Woburn.....      | 5,927     | 1,061   | 17.9 | 252    | 4.25  | 3,209   | 54.1 | 7,313     | 3,714   | 50.8 |
| Worcester.....   | 52,631    | 11,412  | 21.7 | 2,843  | 5.40  | 29,367  | 55.8 | 64,493    | 35,387  | 54.9 |
| Total.....       | 852,266   | 218,988 | 25.7 | 50,468 | 5.92  | 466,729 | 54.8 | 1,037,372 | 577,563 | 55.7 |
| The State.....   | 1,272,110 | 298,601 | 23.5 | 60,634 | 5.47  | 710,036 | 55.8 | 1,542,091 | 838,771 | 54.4 |



The omission is of little importance, however, in connection with this study. Precisely the same method of calculating the working female population having been applied to the 32 cities of Massachusetts for both 1885 and 1905, the figures for the two years are comparable. And, furthermore, as it is mainly with females engaged in manufacturing pursuits that any study of the relations of women's work and infant mortality has to deal, the method necessarily employed fully serves its purpose. It has seemed proper to explain the basis of calculation in order that the table in question and those which follow might give rise to no misunderstanding of their exact meaning. The tables dealing with these same 32 Massachusetts cities which follow have all been worked out on the same basis.<sup>a</sup>

Attention must again be called to the fact that while the foregoing table presents the number and per cent of women of 10 years and over industrially employed, that number is not the fact necessary for an entirely satisfactory basis for discussion. What is really needed is an accurate statement of the number of married, widowed, and divorced women between the ages of 14 and 45 who are employed outside of their homes. The figures in the table are at best but an uncertain indication of what is the true situation in this regard.

In both tables all females of 10 years and over engaged in gainful occupations, other than "domestic service," are included.

The difference in ages of those persons classified as "children at work" in the two decades is to be noted. In the census of 1885 their ages were given as 10 to 13 years, and for 1905 as from 10 to 15 years. In so far as this slight difference in ages is concerned, that discrepancy is apparent rather than real, those working females of ages 14 and 15 not included under the classification of "children at work" in the 1885 figures being otherwise listed in their several occupations in the Massachusetts census for that year, whereas in view of the revised laws of the Commonwealth in 1905 they were not then numbered among the women employed, but included in the number of "children at work" between ages 10 to 15 years.

It will be seen that the illiteracy of the female population 10 years of age and over has been presented as indicative of the educational limitations of the population. While the female illiteracy is usually slightly higher than the illiteracy for the entire population, especially where there is a large per cent of foreign born, the difference is slight. But when the intelligence of motherhood is in question, it would seem to be the more significant factor.

An examination of the table discloses at once a situation practically parallel to that indicated for the larger area of the New England

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<sup>a</sup> A detailed table showing the general occupation groups included in the totals for women gainfully employed in the 32 cities studied, domestic service excluded, will be found in the Appendix (p. 59).



States, namely, there are present a number of interrelated significant factors, and it is not possible to select any one as dominant in the production of a high infant mortality rate or its opposite.

**CITIES HIGHEST IN PER CENT OF WOMEN GAINFULLY EMPLOYED AND IN INFANT DEATH RATE.**

In order to present the situation more clearly, the 10 cities which rank highest in respect to the two main factors under consideration, the per cent of women 10 years of age and over industrially employed and the infant death rate, have been presented in separate tables, which include the other chief factors under consideration in these Massachusetts towns, namely, the birth rate, the per cent of foreign born in the total population, and the per cent of illiteracy in the female population of 10 years and over.

It will be noted that two items have been omitted from this more critical consideration, namely, the per cent of women 10 years of age and over who are married, widowed, or divorced, and the per cent of all women who are between the ages of 14 and 45. It will be found on examination of the preceding table that the last-named point has no significance. The proportion of women between the ages of 14 and 45 is practically constant for each city at the two census periods, and even the variation between different cities is slight, with the exception of one or two residence towns of no importance in this discussion. Concerning the proportion of women 10 years of age and over who are married, widowed, or divorced, there are certain variations which will be noted later, but which do not appear to be of sufficient importance to necessitate its insertion in the tables below.

**INFANT MORTALITY, BIRTH RATE, FOREIGN BORN IN TOTAL POPULATION, AND FEMALE ILLITERACY IN TEN MASSACHUSETTS CITIES HAVING HIGHEST PER CENT OF FEMALES 10 YEARS AND OVER GAINFULLY EMPLOYED.**

1885.

| Cities.              | Per cent of females 10 years of age and over gainfully employed, 1885. <sup>a</sup> | Deaths under 1 year per 1,000 births, 1881-1890. | Births per 1,000 population, 1881-1890. | Per cent of foreign born of total population, 1885. | Per cent of illiterates in female population 10 years of age and over, 1885. |
|----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Lowell.....       | 37.7                                                                                | 222.5                                            | 29.1                                    | 40.37                                               | 12.83                                                                        |
| 2. Holyoke.....      | 37.3                                                                                | 168.1                                            | 42.1                                    | 49.79                                               | 18.91                                                                        |
| 3. Fall River.....   | 37.0                                                                                | 239.7                                            | 32.6                                    | 49.16                                               | 24.93                                                                        |
| 4. Lawrence.....     | 34.7                                                                                | 213.9                                            | 30.2                                    | 43.99                                               | 12.31                                                                        |
| 5. Chicopee.....     | 32.5                                                                                | 176.1                                            | 31.1                                    | 39.79                                               | 21.37                                                                        |
| 6. Waltham.....      | 26.1                                                                                | 131.7                                            | 25.1                                    | 27.47                                               | 7.85                                                                         |
| 7. Lynn.....         | 24.7                                                                                | 140.7                                            | 25.8                                    | 21.30                                               | 5.34                                                                         |
| 8. Haverhill.....    | 23.1                                                                                | 157.1                                            | 26.4                                    | 19.09                                               | 6.14                                                                         |
| 9. New Bedford.....  | 22.8                                                                                | 177.7                                            | 28.9                                    | 30.71                                               | 14.44                                                                        |
| 10. North Adams..... | 22.4                                                                                | 115.1                                            | 42.3                                    | 27.04                                               | 9.68                                                                         |

INFANT MORTALITY, BIRTH RATE, FOREIGN BORN IN TOTAL POPULATION, AND FEMALE ILLITERACY IN TEN MASSACHUSETTS CITIES HAVING HIGHEST PER CENT OF FEMALES 10 YEARS AND OVER GAINFULLY EMPLOYED—Concluded.

## 1905.

| Cities.              | Per cent of females 10 years of age and over gainfully employed, 1905. <sup>a</sup> | Deaths under 1 year per 1,000 births, 1898-1907. | Births per 1,000 population, 1898-1907. | Per cent of foreign born of total population, 1905. | Per cent of illiterates in female population 10 years of age and over, 1905. |
|----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Fall River.....   | 38.6                                                                                | 194.2                                            | 41.1                                    | 43.86                                               | 15.10                                                                        |
| 2. Lawrence.....     | 36.9                                                                                | 181.2                                            | 30.1                                    | 46.08                                               | 10.49                                                                        |
| 3. Lowell.....       | 36.6                                                                                | 208.2                                            | 26.9                                    | 41.73                                               | 7.00                                                                         |
| 4. Holyoke.....      | 34.1                                                                                | 187.8                                            | 31.6                                    | 39.59                                               | 8.83                                                                         |
| 5. Chicopee.....     | 32.2                                                                                | 178.4                                            | 37.6                                    | 39.21                                               | 10.19                                                                        |
| 6. New Bedford.....  | 31.6                                                                                | 172.2                                            | 34.0                                    | 42.70                                               | 12.37                                                                        |
| 7. Waltham.....      | 31.5                                                                                | 103.1                                            | 19.5                                    | 28.23                                               | 5.58                                                                         |
| 8. Lynn.....         | 28.6                                                                                | 133.0                                            | 21.8                                    | 28.52                                               | 2.16                                                                         |
| 9. Marlboro.....     | 27.9                                                                                | 124.0                                            | 21.3                                    | 23.39                                               | 4.03                                                                         |
| 10. North Adams..... | 27.7                                                                                | 121.5                                            | 28.9                                    | 28.14                                               | 6.82                                                                         |

<sup>a</sup> Domestic service excluded.

BIRTH RATE, FOREIGN BORN IN TOTAL POPULATION, AND ILLITERACY AND EMPLOYMENT OF FEMALES IN TEN MASSACHUSETTS CITIES WITH HIGHEST INFANT MORTALITY RATES FOR TWO DECADES.

## 1881-1890.

| Cities.             | Deaths under 1 year per 1,000 births, 1881-1890. | Births per 1,000 population, 1881-1890. | Per cent of foreign-born of total population, 1885. | Per cent of illiterates in female population 10 years of age and over, 1885. | Per cent of females 10 years and over engaged in gainful occupations, 1885. <sup>a</sup> |
|---------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 1. Fall River.....  | 239.7                                            | 32.6                                    | 49.16                                               | 24.93                                                                        | 37.0                                                                                     |
| 2. Lowell.....      | 222.5                                            | 29.1                                    | 40.37                                               | 12.88                                                                        | 37.7                                                                                     |
| 3. Lawrence.....    | 213.9                                            | 30.2                                    | 46.08                                               | 12.31                                                                        | 34.7                                                                                     |
| 4. Boston.....      | 188.2                                            | 30.1                                    | 34.14                                               | 9.55                                                                         | 17.2                                                                                     |
| 5. Salem.....       | 180.6                                            | 24.9                                    | 27.06                                               | 9.26                                                                         | 19.3                                                                                     |
| 6. New Bedford..... | 177.7                                            | 28.9                                    | 30.71                                               | 14.44                                                                        | 22.8                                                                                     |
| 7. Chicopee.....    | 176.1                                            | 31.1                                    | 39.79                                               | 21.37                                                                        | 32.5                                                                                     |
| 8. Cambridge.....   | 172.3                                            | 28.9                                    | 32.16                                               | 9.58                                                                         | 15.2                                                                                     |
| 9. Holyoke.....     | 168.1                                            | 42.1                                    | 49.79                                               | 18.91                                                                        | 37.3                                                                                     |
| 10. Chelsea.....    | 166.9                                            | 25.1                                    | 25.60                                               | 3.03                                                                         | 12.6                                                                                     |

## 1898-1907.

| Cities.             | Deaths under 1 year per 1,000 births, 1898-1907. | Births per 1,000 population, 1898-1907. | Per cent of foreign-born of total population, 1905. | Per cent of illiterates in female population 10 years of age and over, 1905. | Per cent of females 10 years and over engaged in gainful occupations, 1905. <sup>a</sup> |
|---------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 1. Lowell.....      | 208.2                                            | 26.9                                    | 41.73                                               | 7.00                                                                         | 36.6                                                                                     |
| 2. Fall River.....  | 194.2                                            | 41.1                                    | 43.86                                               | 15.10                                                                        | 38.6                                                                                     |
| 3. Holyoke.....     | 187.8                                            | 31.6                                    | 39.59                                               | 8.83                                                                         | 34.1                                                                                     |
| 4. Lawrence.....    | 181.2                                            | 30.1                                    | 46.08                                               | 10.49                                                                        | 36.9                                                                                     |
| 5. Chicopee.....    | 178.4                                            | 37.6                                    | 39.21                                               | 10.19                                                                        | 32.2                                                                                     |
| 6. New Bedford..... | 172.2                                            | 34.0                                    | 42.70                                               | 12.37                                                                        | 31.6                                                                                     |
| 7. Salem.....       | 166.5                                            | 27.1                                    | 29.56                                               | 4.93                                                                         | 24.2                                                                                     |
| 8. Taunton.....     | 156.8                                            | 26.1                                    | 28.67                                               | 7.71                                                                         | 22.4                                                                                     |
| 9. Woburn.....      | 145.7                                            | 19.5                                    | 26.53                                               | 4.25                                                                         | 17.9                                                                                     |
| 10. Boston.....     | 144.0                                            | 27.3                                    | 35.23                                               | 5.42                                                                         | 23.7                                                                                     |

<sup>a</sup> Domestic service excluded.

The exclusion of females employed in the group of occupations classed as "domestic service" was necessary in the foregoing table for the reason that the figures of the 1905 census by cities made no distinction between women who are doing their own housekeeping and those employed for compensation in any of the numerous occupations included under that general heading. The Massachusetts census for 1885 did so differentiate. But no distinction on these lines being available in the case of the 1905 figures, in order to place the returns for both census years on a common basis it was necessary to omit from the table all females so employed. The Twelfth Census puts the total number of females of 10 years of age and over employed in gainful occupations in Massachusetts at 28.1 per cent of the total female population of that age. In the above table, from which these women engaged in "domestic service" have been excluded, the percentage of females of that age employed in Massachusetts in 1905 was 23.5 per cent of the female population of 10 years and over. There is, therefore, an apparent difference of only 4.6 per cent in the two methods. The inclusion of women employed in domestic service for compensation in 1905, therefore, would probably have increased the total of 218,988 women 10 years of age and over gainfully employed in that year in the specified cities, as shown by the table, by from 4 to 5 per cent of the total population of 852,266 females of that age in those cities.

It is at once seen by comparison of these tables that the 6 cities of Fall River, Lawrence, Lowell, New Bedford, Holyoke, and Chicopee are found among the 10 highest, both as regards infant mortality and the employment of women. Again, as in the case of the 6 New England States discussed on pages 22 and 23, if we were to go no further, the indication would be that the high infant mortality is a direct result of the industrial employment of women. But reference to the earlier tables (pp. 28, 30, and 31) at once discloses that these same 6 cities are also among the 10 highest in per cent of foreign-born of the total population and in the per cent of female illiteracy. Not quite the same uniformity is found in regard to the birth rate. It has already been noted that the figures for the birth rate are by no means accurate, especially for the earlier period. In that decennium only Fall River, Holyoke, and Chicopee appear among the 10 highest. In the later period, however, Fall River, Chicopee, New Bedford, Holyoke, and Lawrence are all found among the 10 highest in respect to the birth rate.

The remaining 4 cities in the two tables show great irregularity, and the presence of other influential factors is evident. In other words, while there is a clear relationship between infant mortality and the other circumstances under consideration it is not an invariable relationship.



## CITIES LOWEST IN PER CENT OF WOMEN GAINFULLY EMPLOYED AND IN INFANT DEATH RATE.

The two following tables present the 15 cities which are lowest both for per cent of women gainfully employed and for infant mortality. It was desirable to consider 15 in this group rather than 10, as in the preceding tables, because a large number of strictly residence cities inevitably fall into this group. Hence the group was made larger, so that several cities industrial in character, but with a comparatively low mortality rate, might be included.

INFANT MORTALITY BIRTH RATE, FOREIGN BORN IN TOTAL POPULATION, AND FEMALE ILLITERACY IN FIFTEEN MASSACHUSETTS CITIES HAVING LOWEST PER CENT OF FEMALES 10 YEARS AND OVER GAINFULLY EMPLOYED.

1885.

| Cities.              | Per cent of females 10 years of age and over gainfully employed, 1885. <sup>a</sup> | Deaths under 1 year per 1,000 births, 1881-1890. | Births per 1,000 population, 1881-1890. | Per cent of foreign-born of total population, 1885. | Per cent of illiterates in female population 10 years of age and over, 1885. |
|----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Quincy.....       | 8.4                                                                                 | 124.0                                            | 34.9                                    | 30.34                                               | 7.10                                                                         |
| 2. Gloucester.....   | 8.6                                                                                 | 138.8                                            | 26.4                                    | 32.32                                               | 7.24                                                                         |
| 3. Everett.....      | 9.4                                                                                 | 131.9                                            | 33.6                                    | 20.86                                               | 2.49                                                                         |
| 4. Newton.....       | 10.8                                                                                | 111.9                                            | 22.1                                    | 27.81                                               | 7.31                                                                         |
| 5. Medford.....      | 11.4                                                                                | 130.9                                            | 22.4                                    | 23.38                                               | 5.57                                                                         |
| 6. Somerville.....   | 11.6                                                                                | 154.3                                            | 26.3                                    | 25.02                                               | 5.91                                                                         |
| 7. Chelsea.....      | 12.6                                                                                | 166.9                                            | 25.1                                    | 25.60                                               | 3.03                                                                         |
| 8. Woburn.....       | 12.7                                                                                | 127.0                                            | 32.1                                    | 30.00                                               | 10.71                                                                        |
| 9. Worcester.....    | 14.7                                                                                | 155.6                                            | 31.0                                    | 29.51                                               | 8.70                                                                         |
| 10. Cambridge.....   | 15.2                                                                                | 172.3                                            | 28.9                                    | 32.16                                               | 9.58                                                                         |
| 11. Beverly.....     | 15.9                                                                                | 118.9                                            | 19.8                                    | 14.73                                               | 3.37                                                                         |
| 12. Springfield..... | 16.8                                                                                | 157.3                                            | 27.3                                    | 23.79                                               | 8.74                                                                         |
| 13. Boston.....      | 17.2                                                                                | 188.2                                            | 30.1                                    | 34.14                                               | 9.55                                                                         |
| 14. Fitchburg.....   | 17.6                                                                                | 134.3                                            | 31.2                                    | 23.98                                               | 9.59                                                                         |
| 15. Malden.....      | 17.7                                                                                | 133.4                                            | 28.9                                    | 26.41                                               | 4.24                                                                         |

1905.

| Cities.              | Per cent of females 10 years of age and over gainfully employed, 1905. <sup>a</sup> | Deaths under 1 year per 1,000 births, 1898-1907. | Births per 1,000 population, 1898-1907. | Per cent of foreign-born of total population, 1905. | Per cent of illiterates in female population 10 years of age and over, 1905. |
|----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Quincy.....       | 15.1                                                                                | 111.9                                            | 27.3                                    | 34.26                                               | 3.06                                                                         |
| 2. Gloucester.....   | 15.1                                                                                | 135.2                                            | 23.7                                    | 32.93                                               | 5.70                                                                         |
| 3. Newton.....       | 16.1                                                                                | 112.8                                            | 21.2                                    | 29.07                                               | 2.50                                                                         |
| 4. Medford.....      | 16.5                                                                                | 101.5                                            | 22.1                                    | 22.75                                               | 1.52                                                                         |
| 5. Woburn.....       | 17.9                                                                                | 145.7                                            | 23.2                                    | 26.53                                               | 4.25                                                                         |
| 6. Beverly.....      | 17.9                                                                                | 108.6                                            | 20.3                                    | 23.56                                               | 2.13                                                                         |
| 7. Everett.....      | 19.3                                                                                | 121.5                                            | 26.0                                    | 28.60                                               | 2.04                                                                         |
| 8. Somerville.....   | 19.4                                                                                | 107.2                                            | 23.7                                    | 27.92                                               | 2.49                                                                         |
| 9. Chelsea.....      | 20.9                                                                                | 133.2                                            | 28.2                                    | 37.23                                               | 6.01                                                                         |
| 10. Worcester.....   | 21.7                                                                                | 137.1                                            | 26.7                                    | 32.38                                               | 5.40                                                                         |
| 11. Malden.....      | 21.8                                                                                | 129.3                                            | 22.1                                    | 28.91                                               | 3.51                                                                         |
| 12. Taunton.....     | 22.4                                                                                | 156.8                                            | 26.1                                    | 28.67                                               | 7.71                                                                         |
| 13. Newburyport..... | 22.6                                                                                | 111.3                                            | 21.1                                    | 19.01                                               | 4.40                                                                         |
| 14. Springfield..... | 22.8                                                                                | 125.4                                            | 22.6                                    | 25.21                                               | 4.49                                                                         |
| 15. Northampton..... | 23.1                                                                                | 122.4                                            | 21.4                                    | 24.76                                               | 7.37                                                                         |

<sup>a</sup> Domestic service excluded.



BIRTH RATE, FOREIGN BORN IN TOTAL POPULATION, AND ILLITERACY AND EMPLOYMENT OF FEMALES IN FIFTEEN MASSACHUSETTS CITIES HAVING LOWEST INFANT MORTALITY RATES.

1881 to 1890.

| Cities.              | Deaths under 1 year per 1,000 births, 1881-1890. | Births per 1,000 population, 1881-1890. | Per cent of foreign-born of total population, 1885. | Per cent of illiterates in female population 10 years of age and over, 1885. | Per cent of females 10 years of age and over engaged in gainful occupations, 1885. <sup>a</sup> |
|----------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1. Newton.....       | 111.9                                            | 22.1                                    | 27.81                                               | 7.31                                                                         | 10.8                                                                                            |
| 2. North Adams.....  | 115.1                                            | 42.3                                    | 27.04                                               | 9.68                                                                         | 22.4                                                                                            |
| 3. Quincy.....       | 124.0                                            | 34.9                                    | 30.34                                               | 7.10                                                                         | 8.4                                                                                             |
| 4. Woburn.....       | 127.0                                            | 32.1                                    | 30.00                                               | 10.71                                                                        | 12.7                                                                                            |
| 5. Medford.....      | 130.9                                            | 22.4                                    | 23.38                                               | 5.57                                                                         | 11.4                                                                                            |
| 6. Waltham.....      | 131.7                                            | 25.1                                    | 27.47                                               | 7.85                                                                         | 26.1                                                                                            |
| 7. Everett.....      | 131.9                                            | 33.6                                    | 20.86                                               | 2.49                                                                         | 9.4                                                                                             |
| 8. Malden.....       | 133.4                                            | 28.9                                    | 26.41                                               | 4.24                                                                         | 17.7                                                                                            |
| 9. Fitchburg.....    | 134.3                                            | 31.2                                    | 23.98                                               | 9.59                                                                         | 17.6                                                                                            |
| 10. Northampton..... | 135.7                                            | 23.4                                    | 26.01                                               | 9.20                                                                         | 18.8                                                                                            |
| 11. Gloucester.....  | 138.8                                            | 26.4                                    | 32.32                                               | 7.14                                                                         | 8.6                                                                                             |
| 12. Taunton.....     | 140.5                                            | 27.8                                    | 27.75                                               | 9.04                                                                         | 18.5                                                                                            |
| 13. Lynn.....        | 140.7                                            | 25.8                                    | 21.30                                               | 5.34                                                                         | 24.7                                                                                            |
| 14. Pittsfield.....  | 144.8                                            | 24.6                                    | 23.32                                               | 5.72                                                                         | 19.5                                                                                            |
| 15. Brockton.....    | 146.9                                            | 23.6                                    | 19.40                                               | 4.04                                                                         | 18.8                                                                                            |

1898 to 1907.

| Cities.              | Deaths under 1 year per 1,000 births, 1898-1907. | Births per 1,000 population, 1898-1907. | Per cent of foreign-born of total population, 1905. | Per cent of illiterates in female population 10 years of age and over, 1905. | Per cent of females 10 years of age and over engaged in gainful occupations, 1905. <sup>a</sup> |
|----------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1. Medford.....      | 101.5                                            | 22.1                                    | 22.75                                               | 1.52                                                                         | 16.5                                                                                            |
| 2. Waltham.....      | 103.1                                            | 19.5                                    | 28.23                                               | 5.58                                                                         | 31.5                                                                                            |
| 3. Somerville.....   | 107.2                                            | 23.7                                    | 27.92                                               | 2.49                                                                         | 19.4                                                                                            |
| 4. Pittsfield.....   | 108.5                                            | 22.7                                    | 20.46                                               | 3.87                                                                         | 24.9                                                                                            |
| 5. Beverly.....      | 108.6                                            | 20.3                                    | 23.56                                               | 2.13                                                                         | 17.9                                                                                            |
| 6. Brockton.....     | 109.5                                            | 21.2                                    | 25.68                                               | 2.94                                                                         | 26.8                                                                                            |
| 7. Newburyport.....  | 111.3                                            | 21.1                                    | 19.01                                               | 4.40                                                                         | 22.6                                                                                            |
| 8. Quincy.....       | 111.9                                            | 27.3                                    | 34.26                                               | 3.06                                                                         | 15.1                                                                                            |
| 9. Newton.....       | 112.8                                            | 21.2                                    | 29.07                                               | 2.50                                                                         | 16.1                                                                                            |
| 10. Haverhill.....   | 121.1                                            | 23.6                                    | 23.42                                               | 3.60                                                                         | 26.3                                                                                            |
| 11. North Adams..... | 121.5                                            | 28.9                                    | 28.14                                               | 6.82                                                                         | 27.7                                                                                            |
| 12. Everett.....     | 121.5                                            | 26.0                                    | 28.60                                               | 2.04                                                                         | 19.3                                                                                            |
| 13. Northampton..... | 122.4                                            | 21.4                                    | 24.76                                               | 7.37                                                                         | 23.1                                                                                            |
| 14. Marlboro.....    | 124.0                                            | 21.3                                    | 23.39                                               | 4.03                                                                         | 27.9                                                                                            |
| 15. Springfield..... | 125.4                                            | 22.6                                    | 25.21                                               | 4.49                                                                         | 22.8                                                                                            |

<sup>a</sup> Domestic service excluded.

A study of these two groups of 15 cities shows, as might be anticipated, much less regularity than the preceding groups in respect to the factors under consideration. The first two groups presented are practically all large industrial cities. The second two groups are widely varied in respect to industries and general character.

Of the 15 cities with the lowest infant death rates in the earlier period, 7 appear among the 15 with the lowest percentage of fe-

males employed. In the later period, of the 15 cities with the lowest infant death rate, 9 appear among the 15 with the lowest percentage of females employed. In other words, a low percentage of women employed is not necessarily accompanied by a low infant death rate.

As regards the other tabulated items, on comparison with the table on page 36, in the earlier period it will be found that of the 15 cities lowest in respect to infant mortality, 8 are found among the 15 lowest for the birth rate, 7 are found among the 15 lowest for per cent of foreign-born, 10 are found among the 15 lowest for per cent of female illiteracy. In the later period, 12 are found among the 15 lowest for the birth rate, 13 are found among the 15 lowest for per cent of foreign-born, 11 are found among the 15 lowest for per cent of female illiteracy.

These comparisons indicate, superficially at least, that a more direct relation exists between infant mortality and the birth rate, the per cent of foreign-born, and the per cent of female illiteracy than between infant mortality and the employment of women.

It will be found on comparison of the tables immediately preceding with those on pages 33 and 34 that certain cities show notable irregularities. While in the earlier period the cities of Boston, Cambridge, and Chelsea appear among the 15 having the lowest per cents of women employed, they appear among the 10 highest with regard to infant mortality. In the later period the cities of Woburn and Taunton show a like situation. Of greater significance, however, are certain cities, which show a higher per cent of women industrially employed and a low infant death rate. In the earlier period the cities of Waltham, Lynn, and North Adams appear among the 10 cities having the highest per cent of women employed but are among the 15 lowest as regards infant mortality. In the later period, Waltham, Marlboro, and North Adams are among the 10 with the highest per cent of women employed but are among the 15 with the lowest infant death rates.

#### COMPARISON OF CITIES HIGH IN PERCENTAGE OF WOMEN GAINFULLY EMPLOYED AND WITH HIGH AND LOW INFANT MORTALITY.

To make clear this significant irregularity, the first 14 cities for each decade, according to the number of women industrially employed, were selected for presentation in a special table.

In order that a basis for comparison may be secured, by which to group them further, an arbitrary definition of "high" and "low" infant mortality has been set. For the earlier period, when the rate for the State of Massachusetts was 160.4 per 1,000 births, those cities with a rate over 165 per 1,000 have been considered as having a high rate, and those with a rate of 155 or less have been considered as

having a low rate. For the later period when the rate for the State of Massachusetts was 141.7 per 1,000, those cities having an infant death rate of over 145 per 1,000 have been considered as having a high rate, and those with a rate of 135 or less as having a low rate. These 14 cities were then classified on this basis as having high or low infant mortality rates. Two in each decade were omitted from further consideration because their mortality rates fell within the range of 10 points, which were so near to the average as to be excluded. The remaining 12 in each period are found to divide themselves into groups of 6 each, in respect to their infant death rate, and are presented, together with all related factors statistically available, in the following tables:

COMPARISON OF 12 INDUSTRIAL CITIES OF MASSACHUSETTS HAVING A HIGH PER CENT OF WOMEN AT WORK AS TO INFANT MORTALITY AND OTHER RELATED FACTORS, 1881 TO 1890.

6 CITIES WITH HIGH INFANT MORTALITY (RATE OF OVER 165 PER 1,000 BIRTHS).

| Cities in order of per cent of females 10 years of age and over gainfully employed, 1885. | Total population, 1885. | Per cent of females 10 years of age and over gainfully employed 1885. <sup>a</sup> | Deaths under 1 year per 1,000 births, 1881-1890. | Births per 1,000 of total population, 1881-1890. <sup>b</sup> | Per cent of foreign born of total population, 1885. | Per cent of illiterates in female population 10 years of age and over, 1885. |
|-------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Lowell.....                                                                            | 64,107                  | 37.7                                                                               | 222.5                                            | 29.1                                                          | 40.37                                               | 12.88                                                                        |
| 2. Holyoke.....                                                                           | 27,895                  | 37.3                                                                               | 168.1                                            | 42.1                                                          | 49.79                                               | 18.91                                                                        |
| 3. Fall River.....                                                                        | 56,870                  | 37.0                                                                               | 239.7                                            | 32.6                                                          | 49.16                                               | 24.93                                                                        |
| 4. Lawrence.....                                                                          | 38,862                  | 34.7                                                                               | 213.9                                            | 30.2                                                          | 43.99                                               | 12.31                                                                        |
| 5. Chicopee.....                                                                          | 11,516                  | 32.5                                                                               | 176.1                                            | 31.1                                                          | 39.79                                               | 21.37                                                                        |
| 6. New Bedford.....                                                                       | 33,393                  | 22.8                                                                               | 177.7                                            | 28.9                                                          | 30.71                                               | 14.44                                                                        |
| Total.....                                                                                | 232,643                 | 34.6                                                                               | 208.8                                            | 31.8                                                          | 42.83                                               | 16.90                                                                        |
| The State.....                                                                            | 1,942,141               | 18.3                                                                               | 160.4                                            | 26.2                                                          | 27.13                                               | 9.24                                                                         |

<sup>a</sup> Domestic service is excluded.

<sup>b</sup> Calculated on population of cities at Massachusetts census of 1885.

6 CITIES WITH LOW INFANT MORTALITY (RATE OF LESS THAN 155 PER 1,000 BIRTHS).

| Cities in order of per cent of females 10 years of age and over gainfully employed, 1885. | Total population, 1885. | Per cent of females 10 years of age and over gainfully employed, 1885. | Deaths under 1 year per 1,000 births, 1881-1890. | Births per 1,000 of total population, 1881-1890. | Per cent of foreign born of total population, 1885. | Per cent of illiterates in female population 10 years of age and over, 1885. |
|-------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Waltham.....                                                                           | 14,609                  | 26.1                                                                   | 131.7                                            | 25.1                                             | 27.47                                               | 7.85                                                                         |
| 2. Lynn.....                                                                              | 45,867                  | 24.7                                                                   | 140.7                                            | 25.8                                             | 21.30                                               | 5.34                                                                         |
| 3. North Adams.....                                                                       | 12,540                  | 22.8                                                                   | 115.1                                            | 42.3                                             | 27.04                                               | 9.68                                                                         |
| 4. Marlboro.....                                                                          | 10,941                  | 22.1                                                                   | 154.6                                            | 30.7                                             | 26.17                                               | 13.34                                                                        |
| 5. Pittsfield.....                                                                        | 14,466                  | 19.5                                                                   | 144.8                                            | 24.6                                             | 23.32                                               | 5.72                                                                         |
| 6. Brockton.....                                                                          | 20,783                  | 18.8                                                                   | 146.9                                            | 23.6                                             | 19.40                                               | 4.04                                                                         |
| Total.....                                                                                | 119,206                 | 22.8                                                                   | 138.3                                            | 27.4                                             | 23.01                                               | 6.66                                                                         |



# 40 INFANT MORTALITY AND EMPLOYMENT OF MOTHERS.

COMPARISON OF 12 INDUSTRIAL CITIES OF MASSACHUSETTS HAVING A HIGH PER CENT OF WOMEN AT WORK AS TO INFANT MORTALITY AND OTHER RELATED FACTORS, 1898 TO 1907.

## 6 CITIES WITH HIGH INFANT MORTALITY (RATE OF OVER 145 PER 1,000 BIRTHS).

| Cities in order of per cent of females 10 years of age and over gainfully employed, 1905. | Total population, 1905. | Per cent of females 10 years of age and over gainfully employed, 1905. | Deaths under 1 year per 1,000 births, 1898-1907. | Births per 1,000 of total population, 1898-1907. | Per cent of foreign born of total population, 1905. | Per cent of illiterates in female population 10 years of age and over, 1905. |
|-------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Fall River.....                                                                        | 105,762                 | 38.6                                                                   | 194.2                                            | 41.1                                             | 43.86                                               | 15.10                                                                        |
| 2. Lawrence.....                                                                          | 70,050                  | 36.9                                                                   | 181.2                                            | 30.1                                             | 46.08                                               | 10.49                                                                        |
| 3. Lowell.....                                                                            | 94,889                  | 36.6                                                                   | 208.2                                            | 26.9                                             | 41.73                                               | 7.00                                                                         |
| 4. Holyoke.....                                                                           | 49,934                  | 34.1                                                                   | 187.8                                            | 31.6                                             | 39.59                                               | 8.83                                                                         |
| 5. Chicopee.....                                                                          | 20,191                  | 32.2                                                                   | 178.4                                            | 37.6                                             | 39.21                                               | 10.19                                                                        |
| 6. New Bedford.....                                                                       | 74,362                  | 31.6                                                                   | 172.2                                            | 34.0                                             | 42.70                                               | 12.37                                                                        |
| Total.....                                                                                | 415,188                 | 35.8                                                                   | 189.2                                            | 33.4                                             | 42.81                                               | 10.93                                                                        |
| The State.....                                                                            | 3,003,680               | 23.5                                                                   | 141.7                                            | 25.0                                             | 30.56                                               | 5.47                                                                         |

## 6 CITIES WITH LOW INFANT MORTALITY (RATE OF LESS THAN 135 PER 1,000 BIRTHS).

| Cities in order of per cent of females 10 years of age and over gainfully employed, 1905. | Total population, 1905. | Per cent of females 10 years of age and over gainfully employed, 1905. | Deaths under 1 year per 1,000 births, 1898-1907. | Births per 1,000 of total population, 1898-1907. | Per cent of foreign born of total population, 1905. | Per cent of illiterates in female population 10 years of age and over, 1905. |
|-------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------|
| 1. Waltham.....                                                                           | 26,282                  | 31.5                                                                   | 103.1                                            | 19.5                                             | 28.23                                               | 5.58                                                                         |
| 2. Lynn.....                                                                              | 77,042                  | 28.6                                                                   | 133.0                                            | 21.8                                             | 28.52                                               | 2.16                                                                         |
| 3. Marlboro.....                                                                          | 14,073                  | 27.9                                                                   | 124.0                                            | 21.3                                             | 23.39                                               | 4.03                                                                         |
| 4. North Adams.....                                                                       | 22,150                  | 27.7                                                                   | 121.5                                            | 28.9                                             | 28.14                                               | 6.82                                                                         |
| 5. Brockton.....                                                                          | 47,794                  | 26.8                                                                   | 109.5                                            | 21.2                                             | 25.68                                               | 2.49                                                                         |
| 6. Haverhill.....                                                                         | 37,830                  | 26.3                                                                   | 121.1                                            | 23.6                                             | 23.42                                               | 3.60                                                                         |
| Total.....                                                                                | 225,171                 | 28.1                                                                   | 121.1                                            | 22.4                                             | 26.67                                               | 3.56                                                                         |

EARLIER PERIOD: 1881 TO 1890.

### INDUSTRIES.

It will be seen at once that in the earlier period, 1881 to 1890, the high mortality group is the textile cities. The only notable exception is Holyoke, which is also the leading paper city of the State, that industry employing more persons than the cotton mills. The remaining cities are predominantly cotton cities, excepting Lawrence, where the worsted manufactures predominate.

As to the cities of the low mortality group, Waltham is the center of a great watch industry, but considerable cotton is manufactured. Lynn, Marlboro, and Brockton are distinctively shoe towns. North Adams manufactures both shoes and cotton. Pittsfield manufactures woolen goods in considerable quantities, but shows widely varied industries, such as woodworking and various branches of the metal trades.



POPULATION.

The cities of the high mortality group are much larger than those of the low mortality group. Certain cities in the two groups are fairly comparable, i. e., Lynn and Lawrence, Fall River and New Bedford, Brockton and Holyoke, or Marlboro, North Adams, and Chicopee. But the aggregate population for the 6 high mortality cities is 232,643, while that for the 6 low mortality cities is only 119,206, or almost exactly half that of the high mortality group.

PER CENT OF WOMEN OF 10 YEARS AND OVER GAINFULLY EMPLOYED.

Attention must again be called to the fact that the data presented under this heading are but a makeshift. The real essential is the number of actually employed mothers of children. In the absence of such data, all that can be done is to consider the figures for all women employed upon the assumption that the proportion of married women in that total is approximately proportionate to the number in the female population at large, a doubtful assumption to say the least. On that assumption, however, reference to the table on pages 30 and 31 indicates that out of the total of employed women in the group of low mortality cities a higher per cent of married women would be found than in the high mortality cities, for of the female population 10 years of age and over of Lynn, North Adams, Marlboro, and Brockton, respectively, 58.9 per cent, 56 per cent, 56.2 per cent, and 62.5 per cent are married. Each of these cities is above the average for the 32 cities, and Lynn and Brockton are above the average for the entire State of Massachusetts. On the other hand, Lowell, Fall River, Holyoke, Lawrence, and Chicopee are all below the average for the 32 cities or for the State of Massachusetts, showing per cents of married women of 51.5, 53.2, 50.5, 52.2, and 52.9, respectively.

All of the 12 cities are well above the average for the State as to the proportion of employed women. But in the 6 high mortality cities, the proportion is much higher than in the 6 low mortality cities.

BIRTH RATE.

All the cities in the high mortality group have a birth rate much above that for the State at large. Of the low mortality cities, four have a birth rate below that for the State at large, but two have an extremely high rate, which brings the rate for the group very slightly above that for the State at large.

INFANT DEATH RATE.

The infant mortality of the high mortality group is very much above not only the arbitrary limit set for this discussion, namely, 165 per 1,000, but is extreme in comparison to the infant mortality

rate for the 32 cities which embrace the major portion of the urban population of the State, 174.9 per 1,000 births. On the other hand, the rate for the low mortality group is not only low in comparison to the rate for the 32 cities, but is much below the rate for the State at large, 160.4 per 1,000, a rate in which the rural districts are included. The average rate for the 6 high mortality towns is indeed 70.5 per 1,000 higher than for the low mortality towns, a respectable death rate in itself.

#### FOREIGN BORN AND FEMALE ILLITERACY.

The per cents of foreign born and of female illiteracy show striking similarity, as is to be expected. The per cent of both factors is extremely high for the high mortality towns, and exceptionally low for the low mortality towns, being lower not only than the average for the 32 cities of the State, but for the State at large.

#### LATER PERIOD: 1898 TO 1907.

In the later period the relation of the two groups is practically the same. The only difference is the appearance of Haverhill in the low mortality group, in place of Pittsfield.

The preceding comparison shows clearly the complexity of the problem, and the unwisdom of hasty conclusions. Indeed, all statistical comparisons on this subject, unaccompanied by full information on many subjects not capable of statistical demonstration, must of necessity be inconclusive. A few observations, however, may not here be out of place.

#### POPULATION.

It seems that the size of towns exerts a certain influence. This is a view long held by students of the subject. Size alone, however, can not be determining, for when Holyoke with 49,934 people has an infant death rate of 187.8 per 1,000 births, while Brockton with 47,794 people has an infant death rate of only 109.5 per 1,000 births, or when Lawrence with a population of 70,050 has a death rate of 181.2 per 1,000 births, while Lynn with a population of 77,042 has an infant death rate of but .133 per 1,000 births, while Chicopee with only 20,191 people has a death rate of 178.4 per 1,000 births (later period), something else than the size of the town is the determining factor.

#### BIRTH RATE.

The fact that the birth rate is known to have been inaccurate in the earlier period (1881-1890) has already been noted. The figures for 1898 to 1907, however, may be said to be of value, and the high birth rate of the high mortality group presents a striking contrast to the rate for the low mortality group, though North Adams pre-

sents an exception. In this connection it should be noted that any error of understatement of the birth rate is likely to be considerably greater for the high than for the low mortality group, because the high mortality group of towns have a large foreign population and are to a considerable degree non-English speaking towns, while the low mortality towns have largely an American-born and English-speaking population. Hence complete registration would almost certainly serve to make the disparity between the two groups in this regard even greater than it is.

PER CENT OF WOMEN GAINFULLY EMPLOYED.

The difference in the per cent of women employed in the two groups is not nearly great enough to account for the great difference in infant mortality. Indeed, we have a group of towns which are above the average in the per cent of women employed, and far below it in regard to infant mortality. A causal relation can not, therefore, be said to be shown by this comparison.

FOREIGN-BORN AND FEMALE ILLITERACY.

The per cent of foreign-born and per cent of female illiteracy are clearly related, and may suggest a partial causal relation to infantile mortality.

One fact stands out clearly, however, in considering the two groups of cities, namely, the high mortality group is in general the textile towns, while the low mortality group is in general the shoe towns of the State of Massachusetts.

COMPARISON OF TEXTILE CITIES AND BOOT AND SHOE CITIES.

It is worth while, therefore, to examine in some detail the composition of the groups of female cotton-mill and boot and shoe operatives of Massachusetts, since these two industries are virtually contrasted in regard to the rate of infant mortality of the population which they employ.

The following tables present the main facts for these two groups:

NATIVITY AND PARENTAGE OF FEMALE COTTON-MILL OPERATIVES IN MASSACHUSETTS AND IN THE LEADING TEXTILE CITIES OF THAT STATE, 1905.

[From unpublished data furnished by the Massachusetts Bureau of Statistics, except the totals for the State, which are computed from the Census of Massachusetts, 1905, Vol. II, p. 69.]

NUMBER.

| Female cotton-mill operatives. | The State. | Chicopee. | Fall River. | Fitchburg. | Holyoke. | Lawrence. | Lowell. | New Bedford. | Taunton. |
|--------------------------------|------------|-----------|-------------|------------|----------|-----------|---------|--------------|----------|
| Aggregate number.....          | 44,217     | 1,543     | 12,966      | 942        | 1,768    | 2,899     | 5,524   | 6,896        | 1,213    |
| First generation:              |            |           |             |            |          |           |         |              |          |
| Native-born.....               | 17,110     | 418       | 5,335       | 306        | 735      | 1,183     | 1,865   | 2,094        | 568      |
| Foreign-born.....              | 27,107     | 1,125     | 7,631       | 636        | 1,033    | 1,716     | 3,659   | 4,812        | 645      |
| Second generation:             |            |           |             |            |          |           |         |              |          |
| Native father.....             | 3,606      | 63        | 836         | 56         | 137      | 246       | 476     | 383          | 131      |
| Foreign father.....            | 40,611     | 1,480     | 12,130      | 886        | 1,631    | 2,653     | 5,048   | 6,513        | 1,082    |



NATIVITY AND PARENTAGE OF FEMALE COTTON-MILL OPERATIVES IN MASSACHUSETTS AND IN THE LEADING TEXTILE CITIES OF THAT STATE, 1905—Concl'd.

## NUMBER—Concluded.

| Female cotton-mill operatives.     | The State. | Chicopee. | Fall River. | Fitchburg. | Holyoke. | Lawrence. | Lowell. | New Bedford. | Taunton. |
|------------------------------------|------------|-----------|-------------|------------|----------|-----------|---------|--------------|----------|
| Third generation:                  |            |           |             |            |          |           |         |              |          |
| Both grandparents native.....      | 1,778      | 17        | 256         | 13         | 65       | 128       | 250     | 414          | 43       |
| Both grandparents foreign.....     | 42,315     | 1,520     | 12,661      | 927        | 1,697    | 2,760     | 5,269   | 6,475        | 1,168    |
| Grandparents mixed or unknown..... | 124        | 6         | 49          | 2          | 6        | 11        | 5       | 7            | 2        |
| Place of birth of father:          |            |           |             |            |          |           |         |              |          |
| Native—                            |            |           |             |            |          |           |         |              |          |
| Born in Massachusetts.....         | 1,649      | 24        | 432         | 14         | 51       | 99        | 189     | 195          | 95       |
| Born in other States.....          | 1,957      | 39        | 404         | 42         | 86       | 147       | 287     | 188          | 36       |
| Foreign—                           |            |           |             |            |          |           |         |              |          |
| Ireland.....                       | 9,814      | 346       | 2,960       | 81         | 488      | 880       | 2,018   | 796          | 317      |
| Canada, English.....               | 595        | 29        | 86          | 18         | 39       | 52        | 175     | 39           | 29       |
| Canada, French.....                | 13,317     | 201       | 4,005       | 432        | 564      | 750       | 1,493   | 2,156        | 335      |
| England.....                       | 6,111      | 8         | 3,089       | 22         | 38       | 320       | 364     | 1,595        | 69       |
| Germany.....                       | 857        | 5         | 27          | 59         | 68       | 103       | 8       | 86           | 22       |
| Scandinavia.....                   | 112        | .....     | 18          | 6          | 5        | 3         | 23      | 12           | 4        |
| Italy.....                         | 186        | .....     | 57          | 13         | .....    | 21        | 4       | 14           | 1        |
| Poland.....                        | 1,499      | 328       | 71          | .....      | 42       | 63        | 78      | 38           | 28       |
| Russia.....                        | 460        | 6         | 68          | 186        | 6        | 33        | 26      | 36           | 8        |
| Austria.....                       | 2,936      | 546       | 142         | 8          | 324      | 136       | 202     | 311          | 114      |
| Portugal.....                      | 2,962      | .....     | 1,268       | .....      | .....    | 70        | 266     | 1,207        | 111      |
| Prince Edward Island.....          | 36         | .....     | 4           | .....      | .....    | 12        | 11      | .....        | 2        |
| Newfoundland.....                  | 18         | 1         | 7           | .....      | .....    | .....     | 2       | 1            | .....    |
| Nova Scotia.....                   | 142        | 1         | 26          | 2          | .....    | 15        | 35      | 10           | 2        |
| New Brunswick.....                 | 119        | .....     | 9           | 18         | 1        | 4         | 25      | 4            | 7        |
| Scotland.....                      | 843        | 2         | 224         | 36         | 43       | 94        | 91      | 13           | 27       |
| Wales.....                         | 39         | .....     | 18          | 1          | .....    | 2         | 5       | 6            | 2        |
| France.....                        | 165        | 7         | 12          | 3          | 12       | 27        | 12      | 31           | .....    |
| Other countries.....               | 400        | .....     | 29          | 1          | 1        | 68        | 210     | 38           | 4        |

## PER CENT.

| Aggregate number.....              | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| First generation:                  |       |       |       |       |       |       |       |       |       |
| Native-born.....                   | 38.7  | 27.1  | 41.1  | 32.5  | 41.6  | 40.8  | 33.8  | 30.2  | 46.8  |
| Foreign-born.....                  | 61.3  | 72.9  | 58.9  | 67.5  | 58.4  | 59.2  | 66.2  | 69.8  | 53.2  |
| Second generation:                 |       |       |       |       |       |       |       |       |       |
| Native father.....                 | 8.2   | 4.1   | 6.4   | 5.9   | 7.7   | 8.5   | 8.6   | 5.6   | 10.8  |
| Foreign father.....                | 91.8  | 95.9  | 93.6  | 94.1  | 92.3  | 91.5  | 91.4  | 94.4  | 89.2  |
| Third generation:                  |       |       |       |       |       |       |       |       |       |
| Both grandparents native.....      | 4.0   | 1.1   | 2.0   | 1.4   | 3.7   | 4.4   | 4.5   | 6.0   | 3.5   |
| Both grandparents foreign.....     | 95.7  | 98.5  | 97.6  | 98.4  | 96.0  | 95.2  | 95.4  | 93.9  | 96.3  |
| Grandparents mixed or unknown..... | .3    | .4    | .4    | .2    | .3    | .4    | .1    | .1    | .2    |
| Place of birth of father:          |       |       |       |       |       |       |       |       |       |
| Native—                            |       |       |       |       |       |       |       |       |       |
| Born in Massachusetts.....         | 3.7   | 1.6   | 3.4   | 1.5   | 2.9   | 3.4   | 3.4   | 2.8   | 7.8   |
| Born in other States.....          | 4.4   | 2.5   | 3.1   | 4.5   | 4.9   | 5.1   | 5.2   | 2.7   | 3.0   |
| Foreign—                           |       |       |       |       |       |       |       |       |       |
| Ireland.....                       | 22.2  | 22.4  | 22.8  | 8.6   | 27.6  | 30.4  | 36.5  | 11.5  | 26.1  |
| Canada, English.....               | 1.4   | 1.9   | .7    | 1.9   | 2.2   | 1.8   | 3.2   | .6    | 2.4   |
| Canada, French.....                | 30.1  | 13.0  | 30.9  | 45.9  | 31.9  | 25.9  | 27.0  | 31.3  | 27.6  |
| England.....                       | 13.8  | .5    | 23.9  | 2.3   | 2.1   | 11.0  | 6.6   | 23.1  | 5.7   |
| Germany.....                       | 1.9   | .3    | .2    | 6.3   | 3.8   | 3.6   | .1    | 1.3   | 1.3   |
| Scandinavia.....                   | .3    | ..... | .1    | .6    | .3    | .1    | .4    | .2    | .3    |
| Italy.....                         | .4    | ..... | .4    | 1.4   | ..... | .7    | .1    | .2    | .1    |
| Poland.....                        | 3.4   | 21.3  | .6    | ..... | 2.4   | 2.2   | 1.4   | .6    | 2.3   |
| Russia.....                        | 1.0   | .4    | .5    | 19.8  | .3    | 1.1   | .5    | .5    | .7    |
| Austria.....                       | 6.6   | 35.4  | 1.1   | .8    | 18.3  | 4.7   | 3.7   | 4.5   | 9.4   |
| Portugal.....                      | 6.7   | ..... | 9.8   | ..... | ..... | 2.4   | 4.8   | 17.5  | 9.1   |
| Prince Edward Island.....          | .1    | ..... | (a)   | ..... | ..... | .4    | .2    | ..... | .2    |
| Newfoundland.....                  | .1    | .1    | .1    | ..... | ..... | ..... | (a)   | (a)   | ..... |
| Nova Scotia.....                   | .3    | .1    | .2    | .2    | ..... | .5    | .6    | .1    | .2    |
| New Brunswick.....                 | .3    | ..... | .1    | 1.9   | .1    | .1    | .5    | .1    | .6    |
| Scotland.....                      | 1.9   | .1    | 1.7   | 3.8   | 2.4   | 3.2   | 1.7   | 1.9   | 2.2   |
| Wales.....                         | .1    | ..... | .1    | .1    | ..... | .1    | .1    | .1    | .2    |
| France.....                        | .4    | .4    | .1    | .3    | .7    | .9    | .2    | .4    | ..... |
| Other countries.....               | .9    | ..... | .2    | .1    | .1    | 2.4   | 3.8   | .6    | .3    |

(a) Less than one-tenth of 1 per cent.



NUMBER AND PER CENT OF FEMALE COTTON-MILL OPERATIVES IN SPECIFIED AGE GROUPS IN THE LEADING TEXTILE CITIES OF MASSACHUSETTS AND IN THE STATE, 1905.

[From Cotton Textile Industry, Vol. I, of this report, p. 45. Figures furnished by the Massachusetts Bureau of Statistics from data hitherto unpublished.]

NUMBER.

| Age.                               | The State. | Chicopee. | Fall River. | Fitchburg. | Holyoke. | Lawrence. | Lowell. | New Bedford. | Taunton. |
|------------------------------------|------------|-----------|-------------|------------|----------|-----------|---------|--------------|----------|
| Under 16 years.....                | 2,794      | 73        | 832         | 79         | 169      | 152       | 232     | 411          | 65       |
| 16 to 24 years.....                | 22,265     | 839       | 6,167       | 569        | 1,032    | 1,283     | 2,219   | 3,542        | 696      |
| 25 to 44 years.....                | 16,430     | 562       | 5,122       | 270        | 506      | 1,199     | 2,496   | 2,634        | 403      |
| 45 to 64 years.....                | 2,657      | 68        | 828         | 24         | 60       | 256       | 560     | 304          | 48       |
| 65 years and over and unknown..... | 71         | 1         | 17          | .....      | 1        | 9         | 17      | 5            | 1        |
| Total.....                         | 44,217     | 1,543     | 12,966      | 942        | 1,768    | 2,899     | 5,524   | 6,896        | 1,213    |

PER CENT.

|                                    |       |       |       |       |       |       |       |       |       |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Under 16 years.....                | 6.3   | 4.7   | 6.4   | 8.4   | 9.5   | 5.2   | 4.2   | 5.9   | 5.4   |
| 16 to 24 years.....                | 50.3  | 54.4  | 47.6  | 60.4  | 58.4  | 44.3  | 40.2  | 51.4  | 57.4  |
| 25 to 44 years.....                | 37.2  | 36.4  | 39.5  | 28.7  | 28.6  | 41.4  | 45.2  | 38.2  | 33.2  |
| 45 to 64 years.....                | 6.0   | 4.4   | 6.4   | 2.5   | 3.4   | 8.8   | 10.1  | 4.4   | 3.9   |
| 65 years and over and unknown..... | .2    | .1    | .1    | ..... | .1    | .3    | .3    | .1    | .1    |
| Total.....                         | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

CONJUGAL CONDITION OF FEMALE COTTON-MILL OPERATIVES IN THE LEADING TEXTILE CITIES OF MASSACHUSETTS, 1905.

[From unpublished data furnished by the Massachusetts Bureau of Statistics, except the total for the State, which is from the Census of Massachusetts, 1905, Vol. II, p. 69.]

| City.            | Number.             |          |                       |        | Per cent.           |          |                       |        |
|------------------|---------------------|----------|-----------------------|--------|---------------------|----------|-----------------------|--------|
|                  | Single and unknown. | Married. | Widowed and divorced. | Total. | Single and unknown. | Married. | Widowed and divorced. | Total. |
| The State.....   | 31,253              | 10,863   | 2,101                 | 44,217 | 70.7                | 24.6     | 4.7                   | 100.0  |
| Chicopee.....    | 1,067               | 406      | 70                    | 1,543  | 69.2                | 26.3     | 4.5                   | 100.0  |
| Fall River.....  | 8,751               | 3,615    | 600                   | 12,966 | 67.5                | 27.9     | 4.6                   | 100.0  |
| Fitchburg.....   | 778                 | 133      | 31                    | 942    | 82.6                | 14.1     | 3.3                   | 100.0  |
| Holyoke.....     | 1,482               | 235      | 51                    | 1,768  | 83.8                | 13.3     | 2.9                   | 100.0  |
| Lawrence.....    | 2,045               | 660      | 194                   | 2,899  | 70.5                | 22.8     | 6.7                   | 100.0  |
| Lowell.....      | 3,560               | 1,531    | 433                   | 5,524  | 64.5                | 27.7     | 7.8                   | 100.0  |
| New Bedford..... | 4,737               | 1,879    | 280                   | 6,896  | 68.7                | 27.2     | 4.1                   | 100.0  |
| Taunton.....     | 1,000               | 177      | 36                    | 1,213  | 82.4                | 14.6     | 3.0                   | 100.0  |

ILLITERACY OF FEMALE COTTON-MILL OPERATIVES IN THE LEADING TEXTILE CITIES OF MASSACHUSETTS, 1905.

[From unpublished data furnished by the Massachusetts Bureau of Statistics, except the total for the State, which is from the Census of Massachusetts, 1905, Vol. II, p. 69.]

| City.            | Total number of female operatives. | Number of illiterate female operatives. |                  |                          |        | Per cent of illiterate female operatives. |                  |                          | Percent of illiterate female operatives to total female operatives. |
|------------------|------------------------------------|-----------------------------------------|------------------|--------------------------|--------|-------------------------------------------|------------------|--------------------------|---------------------------------------------------------------------|
|                  |                                    | Unable to read.                         | Unable to write. | Unable to read or write. | Total. | Unable to read.                           | Unable to write. | Unable to read or write. |                                                                     |
| The State.....   | 44,217                             | 2                                       | 495              | 5,193                    | 5,690  | (a)                                       | 8.7              | 91.3                     | 12.9                                                                |
| Chicopee.....    | 1,543                              | .....                                   | 75               | 211                      | 286    | .....                                     | 26.2             | 73.8                     | 18.5                                                                |
| Fall River.....  | 12,966                             | 1                                       | 140              | 1,606                    | 1,747  | 0.1                                       | 8.0              | 91.9                     | 13.5                                                                |
| Fitchburg.....   | 942                                | .....                                   | 9                | 27                       | 36     | .....                                     | 25.0             | 75.0                     | 3.8                                                                 |
| Holyoke.....     | 1,768                              | .....                                   | 6                | 312                      | 318    | .....                                     | 1.9              | 98.1                     | 18.0                                                                |
| Lawrence.....    | 2,899                              | .....                                   | 25               | 322                      | 347    | .....                                     | 7.2              | 92.8                     | 12.0                                                                |
| Lowell.....      | 5,524                              | .....                                   | 63               | 621                      | 684    | .....                                     | 9.2              | 90.8                     | 12.4                                                                |
| New Bedford..... | 6,896                              | .....                                   | 13               | 891                      | 904    | .....                                     | 1.4              | 98.6                     | 13.1                                                                |
| Taunton.....     | 1,213                              | 1                                       | 14               | 137                      | 152    | .7                                        | 9.2              | 90.1                     | 12.5                                                                |

(a) Less than one-tenth of 1 per cent.

## NATIVITY AND PARENTAGE OF FEMALE BOOT AND SHOE OPERATIVES OF MASSACHUSETTS, 1905.

[From Census of Massachusetts, 1905, Vol. II, p. 55.]

|                                    | Number. | Per cent. |                                     | Number. | Per cent. |
|------------------------------------|---------|-----------|-------------------------------------|---------|-----------|
| Aggregate number.....              | 21,224  | 100.0     | Place of birth of father—Concluded. |         |           |
| First generation:                  |         |           | Foreign—Concluded.                  |         |           |
| Native-born.....                   | 16,734  | 78.8      | Canada French.....                  | 2,157   | 10.2      |
| Foreign-born.....                  | 4,490   | 21.2      | England.....                        | 755     | 3.6       |
| Second generation:                 |         |           | Germany.....                        | 324     | 1.5       |
| Native father.....                 | 8,027   | 37.8      | Scandinavia.....                    | 396     | 1.9       |
| Foreign father.....                | 13,197  | 62.2      | Italy.....                          | 265     | 1.2       |
| Third generation:                  |         |           | Poland.....                         | 103     | .5        |
| Both grandparents native.....      | 6,192   | 29.2      | Russia.....                         | 291     | 1.4       |
| Both grandparents foreign.....     | 14,835  | 69.9      | Austria.....                        | 46      | .2        |
| Grandparents mixed or unknown..... | 197     | .9        | Portugal.....                       | 77      | .3        |
| Place of birth of father:          |         |           | Prince Edward Island.....           | 123     | .6        |
| Native-born—                       |         |           | Newfoundland.....                   | 105     | .5        |
| Massachusetts.....                 | 4,710   | 22.2      | Nova Scotia.....                    | 970     | 4.6       |
| Other States.....                  | 3,317   | 15.6      | New Brunswick.....                  | 338     | 1.6       |
| Foreign—                           |         |           | Scotland.....                       | 262     | 1.2       |
| Ireland.....                       | 6,235   | 29.4      | Wales.....                          | 16      | .1        |
| Canada English.....                | 599     | 2.8       | France.....                         | 45      | .2        |
|                                    |         |           | Other countries.....                | 90      | .4        |

## CONJUGAL CONDITION, AGE DISTRIBUTION, AND DEGREES OF ILLITERACY OF THE FEMALE BOOT AND SHOE OPERATIVES OF MASSACHUSETTS, 1905.

[From Census of Massachusetts, 1905, Vol. II, p. 55.]

|                           | Number. | Per cent. |                                 | Number. | Per cent. |
|---------------------------|---------|-----------|---------------------------------|---------|-----------|
| Aggregate number.....     | 21,224  | 100.0     | Age periods—Concluded.          |         |           |
| Conjugal condition:       |         |           | 25 to 44 years.....             | 9,321   | 43.9      |
| Single and unknown.....   | 15,613  | 73.6      | 45 to 64 years.....             | 1,894   | 8.9       |
| Married.....              | 4,050   | 19.1      | 65 and over and unknown.....    | 67      | .3        |
| Widowed and divorced..... | 1,561   | 7.3       | Degree of illiteracy:           |         |           |
| Age periods:              |         |           | Can not write.....              | 20      | 10.4      |
| Under 15 years.....       | 633     | 3.0       | Can neither read nor write..... | 172     | 89.6      |
| 16 to 24 years.....       | 9,309   | 43.9      | Total.....                      | 192     | .9        |

The contrast between these two working forces is best emphasized by the fact that while in 1905, of the female cotton-mill operatives of the State, only 38.7 per cent were native-born, 78.8 per cent of the female shoe operatives were native-born. A marked difference in nativity of fathers also is shown. Of the shoe operatives, 37.8 per cent had native-born fathers, but of the cotton operatives only 8.2 per cent had native-born fathers.

The proportion of married women employed in the two industries does not differ very widely. The cotton industry shows 29.3 per cent of married, widowed, or divorced women employed, while of the boot and shoe operatives 26.4 per cent are married, widowed, or divorced.

The age distribution of the two industries, however, shows a considerable difference. If the number of operatives 16 to 44 years of age was considered, it would appear that the two working forces were practically identical in age composition, since of the boot and shoe operatives 87.8 per cent are of those ages, while of the cotton oper-

atives 87.5 fall in the same age group. But it will be found that while of the shoe operatives 43.9 per cent are 25 to 44 years of age, of the cotton operatives 37.2 per cent are of those ages. In other words, the shoe industry employs older women than the cotton industry. This is only to be expected, in view of the longer training required and the higher wages paid.

The greatest difference, however, is in the per cent of illiteracy of the two groups of women workers. The shoe operatives are practically a literate population, only 192, or 0.90 per cent, of the female shoe operatives of the State being reported as in any degree illiterate. Of the female cotton operatives, on the other hand, 5,690, or 12.9 per cent, were reported as illiterate. In other words, to each illiterate female shoe employee about 30 illiterate female cotton employees are found.

The difference between the economic condition of the two industries is emphasized by the difference in wages. In Bulletin 77, United States Bureau of Labor, pages 163-165, the wages of female closers-on for the State of Massachusetts in 1907 are shown as 19.4 cents per hour for a week averaging 52.69 hours, or a little over \$10 per full week, while female vamps are reported as averaging 26.01 cents per hour for an average week of 55.05 hours, or a little over \$14 for a full week. These occupations embrace the greater part of the female shoe operatives, though not all.

These wages serve to emphasize the well-known fact that the shoe trade is a highly paid industry. On the other hand, in the report on the cotton textile industry, issued also by the Bureau of Labor, it is shown that the largest number of female cotton-mill operatives in 46 representative factories in New England 78.5 per cent earned less than \$9 per week, while 55.5 per cent earned less than \$7 per week.<sup>a</sup> Thus to the wide contrast between these groups of cities as to race, birth rate, and literacy is added a contrast quite as great in the wage-earning power of the people.

#### TEXTILE CITIES OF NEW ENGLAND OUTSIDE OF MASSACHUSETTS.

The following table, which exhibits the situation for a group of textile towns of New England outside of Massachusetts, giving the same data as have been presented for that State, so far as available, shows that the conditions in the Massachusetts textile towns are in no wise exceptional.

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<sup>a</sup> See Cotton Textile Industry, Vol. I of this report, p. 305.



DEATH RATE UNDER 1 YEAR FOR 1900 TO 1907, INCLUSIVE, IN FIVE NEW ENGLAND TEXTILE CITIES OUTSIDE OF MASSACHUSETTS, COMPARED TO THE NUMBER OF WOMEN OF 16 YEARS AND OVER, EMPLOYED IN MANUFACTURES, TOGETHER WITH TOTAL POPULATION, PROPORTION OF FOREIGN-BORN, AND BIRTH RATE.

| State and city. | Total population, 1900. <sup>a</sup> | Per cent of foreign-born of total population, 1900. <sup>b</sup> | Total female population of 16 years and over, 1900. | Females 16 years of age and over employed in manufacturing in 1900. |           | Females 16 years of age and over at work in cotton mills, 1900. | Total births, 1900-1907. |                                                                 | Total deaths under 1 year, 1900-1907. |                              |
|-----------------|--------------------------------------|------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------|-----------|-----------------------------------------------------------------|--------------------------|-----------------------------------------------------------------|---------------------------------------|------------------------------|
|                 |                                      |                                                                  |                                                     | Number.                                                             | Per cent. |                                                                 | Number.                  | Average annual rate per 1,000 of total population. <sup>c</sup> | Number.                               | Death rate per 1,000 births. |
| Maine:          |                                      |                                                                  |                                                     |                                                                     |           |                                                                 |                          |                                                                 |                                       |                              |
| Biddeford.....  | 16,145                               | 44.28                                                            | <sup>d</sup> 5,651                                  | 1,927                                                               | 34.1      | <sup>e</sup> 1,500                                              | 4,289                    | 37.95                                                           | 829                                   | 193.3                        |
| Lewiston.....   | 23,761                               | 39.20                                                            | <sup>d</sup> 8,316                                  | 3,164                                                               | 38.5      | 2,585                                                           | <sup>f</sup> 1,054       | <sup>f</sup> 22.18                                              | <sup>f</sup> 275                      | <sup>f</sup> 260.9           |
| New Hampshire:  |                                      |                                                                  |                                                     |                                                                     |           |                                                                 |                          |                                                                 |                                       |                              |
| Manchester..... | 56,987                               | 42.56                                                            | 21,547                                              | 8,236                                                               | 38.2      | 5,578                                                           | 12,539                   | 31.43                                                           | 2,774                                 | 221.2                        |
| Rhode Island:   |                                      |                                                                  |                                                     |                                                                     |           |                                                                 |                          |                                                                 |                                       |                              |
| Pawtucket.....  | 39,231                               | 33.36                                                            | 14,187                                              | 4,343                                                               | 30.6      | 1,933                                                           | 8,216                    | 29.92                                                           | 1,323                                 | 161.0                        |
| Woonsocket..... | 28,204                               | 44.38                                                            | 9,508                                               | 2,635                                                               | 27.7      | 1,092                                                           | 8,228                    | 41.08                                                           | 1,287                                 | 156.4                        |

<sup>a</sup> Twelfth Census, 1900, Population, Part I, Table 8.

<sup>b</sup> Computed from Twelfth Census, 1900, Population, Part I, Table 24.

<sup>c</sup> Rate computed on population at Twelfth Census, 1900.

<sup>d</sup> The reports of the Twelfth Census do not classify by ages the population of cities of less than 25,000, and there being no official age returns for the female population of Biddeford, Lewiston, Chicopee, and Burlington, the number of females 16 years of age and over in each of those cities has been estimated on the basis of 35 per cent of the total population in 1900, that having been, roughly speaking, the average ratio of females of 16 years of age and over to the total population of the New England States in 1900.

<sup>e</sup> In default of United States Census returns regarding the number of women of 16 years of age and over employed in the cotton mills of this city in 1900, the numbers in question have been roughly estimated on the basis of the most reliable local information obtainable.

<sup>f</sup> Figures are restricted to years 1906 and 1907, as prior to 1906 deaths for Lewiston were not separately reported.

In addition, at the close of this article will be found a detailed tabulation of the infant deaths and the deaths of children aged 1 to 4 years for the 13 New England cities studied by specific causes, as reported in the mortality returns of the United States Census Office for 1900 to 1908, inclusive.

### CONCLUSION.

As noted at the beginning of this study, it has often been customary, in approaching statistically the subject of the employment of married women in its relation to infant mortality, to ignore the many other complex social and economic factors having a bearing upon the problem. The preceding tables show clearly that in the cities of New England certain of these factors which in the past have been ignored in the consideration of the problem are with fair uniformity coexistent with a high infant mortality rate; these being (1) a high proportion of foreign born, (2) a high female illiteracy, and (3) a high birth rate. These factors operate with equal force over large or small areas—that is, the results when the six New England States are regarded as units are not different than when individual cities of the



State of Massachusetts are studied as units, the degree of urbanization of the population taking the place of the size of towns, and accompanying the infant death rate with almost perfect regularity through the last three census periods.

The two other factors considered in this study relate themselves with less regularity to the infant death rate. The first of these is the size of cities. Large towns, in general, have rather higher rates than small towns, although, as already noted, this relationship is found not to be invariable. For example, in the decade 1898-1907 the city of Lynn, with a population of 77,042, had an infant death rate of but 133 per 1,000 births, while Lawrence, with a population of 70,050, had a death rate of 181.2 per 1,000; Brockton, with a population of 47,794, of only 109.5 per 1,000 births, while Chicopee, with a population of only 20,191, had an infant death rate of 178.4 per 1,000 births.

The second factor which is found, statistically speaking, associated very uncertainly, to say the least, with the infant death rate, is the subject of this study—the proportion of women engaged in extra-domestic occupations.

It is true that the six cities of Massachusetts having an extremely high infant death rate, have also a high proportion of women employed in extra-domestic occupations (see tables pp. 39 and 40). It is likewise true that these six cities with abnormal infant death rates have a considerably higher proportion of women so employed than the six industrial cities with low infant mortality rates presented with them for purposes of comparison. But the fact must not be lost sight of that, while the six cities with low infant death rates do show a smaller proportion of women industrially employed than the six high mortality cities, the per cent of women so employed in the six low mortality cities is a little higher than the per cent for the 32 cities shown on pages 30 and 31 and considerably higher than the per cent for the State of Massachusetts as a whole, while the infant mortality rate is not only lower than the rate for the 32 cities but is 19 per 1,000 less than the rate for the State at large, in which rural districts have been included. It will be seen that this result clearly disproves the contention that the extra-domestic employment of women is the dominant factor in determining the infant death rate so far as the Massachusetts cities are concerned.

It is desirable for a moment to revert to the real question of prime importance in the relation of women's work to infant mortality, namely, how many mothers of young children return to industrial employment outside of their homes before their infants have attained to the age of 1 year? Little accurate information is available, but the Report on the Condition of Woman and Child Wage-Earners

in the Cotton Textile Industry, to which previous reference has been made, shows that only 23, or 14.1 per cent, out of 163 married women working in cotton mills who were scheduled in New England had children under 3 years of age.<sup>a</sup> The distribution of these 23 children by ages in detail is not shown; but it is obvious that the proportion of women working in the cotton mills who have infants (children under 1 year) at home must be very small at any particular time, and in no wise sufficient to account for the excessive infant mortality rate of the textile cities. The fact that the employment of mothers is not the chief factor in its determination is indicated conclusively by the detailed study of the infant mortality of Fall River during 1908, presented as Part II of this volume.

It has been noted repeatedly that the proportion which the number of foreign-born bears to the total population, the degree of urbanization, or size of cities, the birth rate, and the per cent of female illiteracy, bear, with few exceptions, a constant and striking relation to the infant death rate.

But it must not be inferred that these, any more than the extra-domestic employment of women, are the real causes which determine that death rate. All the factors discussed in this study are rather the indices of the true causes of high or low infant death rates, the causes themselves lying deep in the social and economic structure of the different population units under consideration.

These true causes have already received study abroad, and to a less degree have been investigated in the United States more recently, and a brief summary of the findings in the case will best serve to correlate the statistical facts presented in this paper with the conditions of whose presence they are the outward sign.

It is well again to emphasize the fundamental proposition, effectively stated by Doctor Newman, that "the causes of infant mortality are composite. It has been well said that every effect has an ancestry of causes. Preeminently is this the case in regard to infant mortality, which is due to a combination of factors closely interrelated."<sup>b</sup> He

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<sup>a</sup> The Report on the Condition of Woman and Child Wage-Earners in the Cotton Textile Industry (Vol. I of this report, pp. 1010 and 1032), to which previous reference has been made, shows that out of 407 married women living in the Massachusetts cotton-mill families visited in the course of the investigation of the Bureau of Labor only 101 married women were at work as wage-earners at the time of the visits, and that only 13, or 12.9 per cent, of these were mothers of children under 3 years of age. Out of 806 married women living in the New England families included in the same investigation 175 married women were at work, and only 23, or 14.1 per cent, had children under 3 years of age. Compare Men's Ready-Made Clothing, Volume II of this report, showing that only 9.9 per cent of the married women at work (not including home finishers) had children under 3 years of age; Glass Industry, Volume III, with 14.1 per cent; and Silk Industry, with 17.3 per cent.

<sup>b</sup> Newman: Infant Mortality, p. 60.

further observes concerning the facts which seem to him to be indicated by a detailed examination of England's infant mortality statistics through many years:

1. Nearly one-half (about 48 per cent) of the infant deaths in towns occur in the first three months of life;

2. The chief fatality in these first three months is caused by prematurity and immaturity;

3. By far the greatest fatality in the remainder of the first year of life is due to inflammatory conditions of the lungs and to epidemic diarrhea; and

4. Infant mortality is not declining owing to the fact that while certain diseases have enormously decreased, prematurity, pneumonia, and epidemic diarrhea have, in spite of all advance in science, steadily increased, particularly in the towns and where the lamp of social life burns low.

Doctor Newsholme's observations, made in a recent official report,<sup>a</sup> are, generally speaking, in agreement with Doctor Newman's statement of the salient facts, with the exception that Doctor Newsholme does not consider that there has been an absolute increase in England and Wales in deaths from prematurity. He states his conclusion thus: "There does not appear to be sufficient foundation for the statement that prematurity to an increasing extent is a cause of mortality in the English experience. There has probably been much transference of certification between different vague (related) causes of death, and it is safer to consider all these vague conditions together under a common heading. When this is done, evidence of increased death rate disappears."<sup>b</sup>

Two additional observations by Doctor Newsholme should be added to the conclusions of Doctor Newman:

1. A high infant death rate in a given community implies in general a high death rate in the next four years of life, while low death rates at both age periods are similarly associated.<sup>c</sup>

2. It is clear that the counties having high infant mortalities continue in general to suffer somewhat excessively throughout the first twenty years of human life, and that counties having low infantile mortalities continue to have relatively low death rates in the first twenty years of life, though the superiority is not so great at the later as at the earlier ages.<sup>d</sup>

With these fundamental facts in mind it is possible to pass to a consideration of the true factors which influence infant mortality. The following statement of Doctor Newsholme, while referring to

<sup>a</sup> Great Britain, Local Government Board, Supplement to Thirty-ninth Annual Report.

<sup>b</sup> Ibid., p. 35.

<sup>c</sup> Ibid., p. 13.

<sup>d</sup> Ibid., p. 17.



English conditions, is apparently almost equally applicable to the conditions prevalent in Massachusetts:

These [influences] may be classified into prenatal, acting through the mother and dependent on her health; natal, and still in large measure due to the condition of the mother, e. g., causes of difficult parturition, though the skill of the doctor or midwife is also largely concerned; and postnatal, which arise from environmental conditions.

It has been already seen that in the counties of England and Wales showing excessive or low infant mortality these different causes of high or low mortality are acting together to such an extent as to be almost inextricable. I prefer, therefore, for the present, to accept the tangle and to discuss the factors of infant mortality apart from any such attempt at separation.

Among the influences affecting infant mortality are the following. They are not given in order of importance.

1. The proportion of male to female births.
2. The proportion of legitimate to illegitimate births.
3. The magnitude of the birth rate, which may for the present purpose be otherwise put as the size of the family.
4. The number of stillbirths.
5. The quality of the help given at birth.
6. The age of the wife at marriage.
7. Poverty and social conditions.
8. The extra-domestic employment of married women.
9. Urban or rural conditions of life.
10. Domestic and municipal sanitation.
11. Conditions of housing.
12. Ignorance and fecklessness of mothers.

Obviously the above list is incomplete, and still more obviously the different factors overlap at various points.

It is beyond the province of this study to discuss in detail this complicated list of factors; but because of the bearing of certain of them upon the relation of the extra-domestic employment of married women to the infant death rate, these must be separately considered. It will be recalled that those factors statistically presented with the two just named were the proportion of foreign-born in the total population, the degree of urbanization of the population, the birth rate, and female illiteracy.

It may at first appear that two of these four factors, which were found to show an almost invariable statistical relation to the infant death rate of Massachusetts and of New England, namely, the proportion of foreign born and of female illiteracy, are unrelated to the determining influences listed by Doctor Newsholme. But a moment's observation will show that these two factors are but another expression of some of the most important factors named by him.

The newly arrived immigrant, especially if he be of a non-English speaking race, must usually begin at the bottom of the industrial ladder and, therefore, is usually poor. He crowds into cities, thus



rapidly increasing the degree of urbanization and the size of the cities. Owing to his ignorance, his poverty, and his low standard of life he is often found under the worst housing conditions which our cities afford. More than that, he not only lives in the worst houses, but in the worst districts of our cities, speaking from the sanitary viewpoint, and as if this is not enough, coupled with the unfair treatment which his adopted city gives him in the form of wretched housing and squalid streets, his wife, unused to the living conditions into which she finds herself thrust, is likely to be none too successful in her efforts to cope with the situation, and her house-keeping is often far from sanitary according to the standard necessary for urban health.

More than this, there is a distinct tendency to early marriage and large families among the foreign born, thus accentuating poverty, and owing to the custom among them of employing midwives, the quality of help given at birth is frequently far from good.

The proportion of foreign born in a given population also would serve in the absence of other data as an index of the ignorance of mothers, but in this case we have the high per cent of female illiteracy in the high mortality towns, a rough but valuable index of what Doctor Newsholme calls the "ignorance and fecklessness of mothers."

In other words, a high proportion of foreign born in a city, with its correlative, the per cent of female illiteracy, indicates with reasonable assurance that in that city—

(a) A large proportion of its population will live in poverty.

(b) A large proportion will live under the worst conditions as to, housing, domestic and municipal sanitation. This is likely to involve, it will be remembered, a bad milk supply and all the conditions of filth which are the powerful causes of epidemic diarrhea in infants.

(c) In such a city, with the preponderance of foreign traditions and standards, a large proportion of its women will marry young and bear large families.

(d) At birth too often the care given will be that of an ignorant midwife.

(e) After birth the mother, hampered by poverty and ignorance, often will have little idea how to care for her child.

It would seem, therefore, that at least some of Doctor Newsholme's conclusions as to the significance of these influences would be applicable equally to England or to Massachusetts. He finds that—

1. "Large families evidently do not necessarily imply a tendency to high infant mortality. The connection often observed between a high birth rate and a high rate of infant mortality probably is due in great part to the fact that large families are common among the poorest classes, and these classes are specially exposed to the degrading

influences producing excessive infant mortality."<sup>a</sup> Expressed in another form and applied to Massachusetts, the high birth rate of the Massachusetts cities having also a high death rate means that a large number of infants are born into conditions under which they can not survive.

2. As to the quality of help given at birth "there is much *prima facie* evidence pointing to negligent and careless attendance in child birth and to consequently excessive mortality not only of mothers but also of infants in early infancy."<sup>b</sup>

3. "Early motherhood is associated to a minor extent with a relatively high infant mortality."

4. "Infant mortality is higher among the poor than among the well-to-do, although natural feeding of infants is probably more general among the former."

5. "Infant mortality is always highest in crowded centers of population; but a high infant mortality can (by proper measures as to sanitation and housing) be avoided even under conditions of dense aggregation of population."<sup>c</sup>

6. "Infant mortality is highest in those counties where, under urban conditions of life, filthy privies are permitted, where scavenging is neglected, and where the streets and yards are to a large extent not 'made up' or 'paved.'"<sup>d</sup>

"Diarrhea is most prevalent where municipal sanitation is bad. It can not be entirely removed unless infants' food is prepared under absolutely cleanly conditions."

7. Doctor Newsholme quotes with approval in regard to the ignorance of mothers the following statement by Doctor Reid, county medical officer for Staffordshire:

"Of course there are many contributory causes of excessive infant mortality, most of which are preventable, but there is one which far exceeds all others in potency, namely, the prevailing ignorance among mothers as to the proper feeding of infants."<sup>e</sup>

An American authority on the diseases of children has recently reiterated this conclusion of Doctor Reid: "It is generally agreed that fully one-half of these infant deaths could be prevented by adequate measures of relief. In proof of this are two incontrovertible facts: First, the death rate among exclusively breast-fed babies is comparatively small. Second, the death rate among artificially fed babies, properly cared for and given the best artificial diet, is like-

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<sup>a</sup> Great Britain, Local Government Board, Supplement to Thirty-ninth Annual Report, p. 49.

<sup>b</sup> *Ibid.*, p. 52.

<sup>c</sup> *Ibid.*, p. 75.

<sup>d</sup> *Ibid.*, p. 78.

<sup>e</sup> *Ibid.*, p. 101.

wise small. Ignorance on the part of the mother is perhaps the greatest single factor in this annual slaughter of the innocents." <sup>a</sup>

It seems only reasonable to conclude that the presence of the conditions indicated above as productive of a high infant mortality are amply sufficient to account for the high mortality of the textile cities of Massachusetts, and that their absence in the great shoe cities, as indicated by the fact that the proportion of foreign-born is low, the illiteracy of the female population insignificant, and the wages in the dominant industry high, accounts for the relatively low infant mortality rates of those cities. That these factors are true indices of generally good conditions in the latter group is clearly shown by their general death rates. Brockton, with a general death rate of only 13.20 in 1900, was by far the healthiest city of its size in the entire East, and but 27 of all the 343 registration cities in the United States had a rate equally low. Lynn also had a comparatively low general death rate, and Haverhill, Marlboro, North Adams, and Waltham have all been well below the average general death rate of registration cities for many years. <sup>b</sup>

The point now to be considered is the English experience in regard to the employment of married women in extra-domestic occupations. It has been repeatedly emphasized that for the cities of Massachusetts accurate figures are not available, and in lieu of them the proportion of women of 10 years and over industrially employed has been taken as an index of the significance of this factor.

It was clearly shown that the statistics for the 32 cities of Massachusetts considered in detail in the preceding pages in no wise bear out the frequent assumption that the employment of married women is a major factor in determining the infant death rate. A detailed study of the infant mortality in Fall River, to which reference has been made, <sup>c</sup> likewise fails to support this contention.

In Great Britain the statement of Sir John Simon, already quoted, of that assumed relationship has been generally accepted without question until of late years. The interdepartmental committee on physical deterioration, however, which reported in 1904, although it cited much evidence which maintained its accuracy was, on the whole, rather noncommittal in its report, which stated that "though the facts seem to point to a strong presumption that it [excessive infant mortality] is also connected with the employment of mothers, the information is not so complete as might be desired." <sup>d</sup> In 1908,

<sup>a</sup> J. H. Mason Knox, jr., In Journal of the American Public Health Association, January, 1911, p. 44.

<sup>b</sup> See Massachusetts State Board of Health, Report for 1908, p. 812, and Twelfth Census, Vol. III, Part I, pp. 292-554.

<sup>c</sup> See Part II of this volume.

<sup>d</sup> Report of the Inter-Departmental Committee on Physical Deterioration, Vol. I, p. 45.



in commenting upon Doctor Simon's statements, Doctor Newman qualified them slightly: "We can not now, with the new facts and experience of half a century behind us, wholly subscribe to these conclusions."<sup>a</sup> He admitted also that certain towns with a high infant mortality showed a low proportion of occupied women, and pointed out the complexity of the supposed relationship:

But the mere fact of extensive employment of women, and particularly of mothers in factories, can not be regarded as significant of itself. To gauge the effect of such employment on the children of such women, reference must be made to some of the following factors which play a part in the problem, namely, (a) the character and condition of the work, (b) the length of hours, (c) employment before and after childbirth, and (d) the sanitation of factories and workshops. To these also should be added the variations in the birth rate prevalent in different trades, the effect of certain industries upon maternity in the way of raising (if such be possible) or reducing the standard and practice of mothers as to the care of infants, and, lastly, the causes of the mothers' employment.

Doctor Newsholme, in a detailed analysis of the infant mortality statistics of England and Wales, has found that a study of the industries involved confirms the conclusion that the employment of married women is not a dominant factor, but reaches the reasonable conclusion that because it is not the greatest cause it does not follow that it is to be ignored.

It will thus be seen that this study, in indicating that the employment of women is not a controlling factor in determining the infant death rates of the cities of Massachusetts, is in exact agreement with the results of a careful analysis of English statistics through a long period.

#### APPENDIX.

TABLE I.—BIRTHS, AND DEATHS OF CHILDREN UNDER 1 YEAR OF AGE, IN 32 MASSACHUSETTS CITIES, 1898 TO 1907.

[Compiled by the Bureau of the Census.]

| Year.       | Beverly. |                      | Boston. |                      | Brockton. |                      | Cambridge. |                      | Chelsea. |                      |
|-------------|----------|----------------------|---------|----------------------|-----------|----------------------|------------|----------------------|----------|----------------------|
|             | Births.  | Deaths under 1 year. | Births. | Deaths under 1 year. | Births.   | Deaths under 1 year. | Births.    | Deaths under 1 year. | Births.  | Deaths under 1 year. |
| 1898.....   | 291      | 36                   | 16,577  | 2,569                | 871       | 118                  | 2,594      | 416                  | 915      | 149                  |
| 1899.....   | 266      | 40                   | 16,151  | 2,401                | 915       | 100                  | 2,508      | 377                  | 855      | 119                  |
| 1900.....   | 322      | 34                   | 16,328  | 2,400                | 945       | 115                  | 2,648      | 364                  | 929      | 140                  |
| 1901.....   | 277      | 24                   | 15,561  | 2,289                | 902       | 102                  | 2,525      | 344                  | 944      | 108                  |
| 1902.....   | 293      | 28                   | 15,516  | 2,269                | 934       | 80                   | 2,476      | 308                  | 939      | 146                  |
| 1903.....   | 283      | 40                   | 15,664  | 2,181                | 918       | 88                   | 2,528      | 322                  | 962      | 143                  |
| 1904.....   | 300      | 26                   | 15,660  | 2,219                | 992       | 113                  | 2,528      | 292                  | 1,066    | 128                  |
| 1905.....   | 308      | 33                   | 15,631  | 2,266                | 1,119     | 109                  | 2,453      | 305                  | 1,225    | 159                  |
| 1906.....   | 359      | 45                   | 17,062  | 2,450                | 1,171     | 129                  | 2,768      | 323                  | 1,251    | 155                  |
| 1907.....   | 386      | 29                   | 18,229  | 2,351                | 1,354     | 154                  | 2,826      | 312                  | 1,439    | 154                  |
| Total ..... | 3,085    | 335                  | 162,479 | 23,395               | 10,121    | 1,108                | 25,854     | 3,363                | 10,515   | 1,401                |

<sup>a</sup>Newman, Infant Mortality, p. 98.



TABLE I.—BIRTHS, AND DEATHS OF CHILDREN UNDER 1 YEAR OF AGE, IN 32 MASSACHUSETTS CITIES, 1898 TO 1907—Continued.

| Year.       | Chicopee. |                      | Everett. |                      | Fall River. |                      | Fitchburg. |                      | Gloucester. |                      |
|-------------|-----------|----------------------|----------|----------------------|-------------|----------------------|------------|----------------------|-------------|----------------------|
|             | Births.   | Deaths under 1 year. | Births.  | Deaths under 1 year. | Births.     | Deaths under 1 year. | Births.    | Deaths under 1 year. | Births.     | Deaths under 1 year. |
| 1898.....   | 738       | 146                  | 708      | 93                   | 4,726       | 780                  | 940        | 142                  | 651         | 105                  |
| 1899.....   | 700       | 126                  | 654      | 91                   | 3,987       | 869                  | 914        | 119                  | 582         | 82                   |
| 1900.....   | 752       | 157                  | 781      | 103                  | 4,327       | 885                  | 1,013      | 157                  | 667         | 78                   |
| 1901.....   | 729       | 120                  | 725      | 101                  | 4,054       | 728                  | 1,007      | 126                  | 643         | 77                   |
| 1902.....   | 787       | 144                  | 747      | 101                  | 4,341       | 893                  | 937        | 135                  | 635         | 90                   |
| 1903.....   | 755       | 136                  | 780      | 89                   | 4,448       | 864                  | 974        | 127                  | 646         | 81                   |
| 1904.....   | 766       | 111                  | 756      | 78                   | 4,514       | 806                  | 968        | 112                  | 601         | 86                   |
| 1905.....   | 726       | 124                  | 764      | 96                   | 4,092       | 846                  | 953        | 126                  | 594         | 89                   |
| 1906.....   | 805       | 137                  | 789      | 82                   | 4,333       | 812                  | 986        | 163                  | 598         | 80                   |
| 1907.....   | 836       | 154                  | 875      | 87                   | 4,622       | 899                  | 1,075      | 135                  | 557         | 67                   |
| Total ..... | 7,594     | 1,355                | 7,579    | 921                  | 43,444      | 8,382                | 9,767      | 1,342                | 6,174       | 835                  |

| Year.       | Haverhill. |                      | Holyoke. |                      | Lawrence. |                      | Lowell. |                      | Lynn.   |                      |
|-------------|------------|----------------------|----------|----------------------|-----------|----------------------|---------|----------------------|---------|----------------------|
|             | Births.    | Deaths under 1 year. | Births.  | Deaths under 1 year. | Births.   | Deaths under 1 year. | Births. | Deaths under 1 year. | Births. | Deaths under 1 year. |
| 1898.....   | 889        | 119                  | 1,633    | 323                  | 1,958     | 365                  | 2,413   | 520                  | 1,500   | 223                  |
| 1899.....   | 892        | 104                  | 1,692    | 257                  | 1,786     | 404                  | 2,415   | 555                  | 1,533   | 189                  |
| 1900.....   | 915        | 105                  | 1,663    | 307                  | 2,102     | 401                  | 2,596   | 524                  | 1,563   | 231                  |
| 1901.....   | 819        | 86                   | 1,634    | 292                  | 1,921     | 354                  | 2,794   | 547                  | 1,567   | 196                  |
| 1902.....   | 802        | 114                  | 1,500    | 251                  | 1,958     | 353                  | 2,493   | 524                  | 1,477   | 184                  |
| 1903.....   | 877        | 101                  | 1,512    | 326                  | 2,045     | 361                  | 2,519   | 562                  | 1,559   | 204                  |
| 1904.....   | 912        | 105                  | 1,463    | 287                  | 2,047     | 321                  | 2,519   | 501                  | 1,724   | 234                  |
| 1905.....   | 834        | 106                  | 1,514    | 268                  | 2,089     | 413                  | 2,500   | 494                  | 1,698   | 256                  |
| 1906.....   | 1,012      | 140                  | 1,570    | 320                  | 2,409     | 432                  | 2,547   | 544                  | 2,065   | 255                  |
| 1907.....   | 977        | 101                  | 1,610    | 334                  | 2,761     | 414                  | 2,704   | 537                  | 2,110   | 262                  |
| Total ..... | 8,929      | 1,081                | 15,791   | 2,965                | 21,076    | 3,818                | 25,500  | 5,308                | 16,801  | 2,234                |

| Year.       | Malden. |                      | Marlboro. |                      | Medford. |                      | New Bedford. |                      | Newburyport. |                      |
|-------------|---------|----------------------|-----------|----------------------|----------|----------------------|--------------|----------------------|--------------|----------------------|
|             | Births. | Deaths under 1 year. | Births.   | Deaths under 1 year. | Births.  | Deaths under 1 year. | Births.      | Deaths under 1 year. | Births.      | Deaths under 1 year. |
| 1898.....   | 848     | 128                  | 336       | 32                   | 365      | 53                   | 2,048        | 387                  | 282          | 34                   |
| 1899.....   | 768     | 100                  | 306       | 52                   | 437      | 43                   | 2,065        | 362                  | 282          | 36                   |
| 1900.....   | 764     | 118                  | 279       | 59                   | 446      | 59                   | 2,230        | 439                  | 314          | 39                   |
| 1901.....   | 827     | 115                  | 265       | 28                   | 459      | 44                   | 2,440        | 364                  | 312          | 39                   |
| 1902.....   | 800     | 96                   | 289       | 35                   | 416      | 44                   | 2,437        | 446                  | 350          | 54                   |
| 1903.....   | 794     | 107                  | 319       | 38                   | 450      | 41                   | 2,469        | 457                  | 315          | 33                   |
| 1904.....   | 820     | 91                   | 282       | 28                   | 433      | 44                   | 2,620        | 448                  | 328          | 26                   |
| 1905.....   | 859     | 100                  | 303       | 33                   | 427      | 42                   | 2,765        | 421                  | 305          | 37                   |
| 1906.....   | 883     | 120                  | 321       | 39                   | 454      | 35                   | 2,949        | 462                  | 299          | 31                   |
| 1907.....   | 1,033   | 111                  | 299       | 28                   | 469      | 37                   | 3,272        | 570                  | 304          | 15                   |
| Total ..... | 8,396   | 1,086                | 2,999     | 372                  | 4,356    | 442                  | 25,295       | 4,356                | 3,091        | 344                  |

TABLE I.—BIRTHS, AND DEATHS OF CHILDREN UNDER 1 YEAR OF AGE, IN 32 MASSACHUSETTS CITIES, 1898 TO 1907—Concluded.

| Year.      | Newton. |                      | North Adams. |                      | Northampton. |                      | Pittsfield. |                      | Quincy. |                      |
|------------|---------|----------------------|--------------|----------------------|--------------|----------------------|-------------|----------------------|---------|----------------------|
|            | Births. | Deaths under 1 year. | Births.      | Deaths under 1 year. | Births.      | Deaths under 1 year. | Births.     | Deaths under 1 year. | Births. | Deaths under 1 year. |
| 1898.....  | 808     | 126                  | 731          | 86                   | 390          | 62                   | 530         | 68                   | 776     | 82                   |
| 1899.....  | 767     | 95                   | 612          | 84                   | 387          | 31                   | 495         | 59                   | 707     | 108                  |
| 1900.....  | 796     | 111                  | 726          | 98                   | 428          | 75                   | 476         | 77                   | 752     | 81                   |
| 1901.....  | 752     | 89                   | 674          | 94                   | 399          | 50                   | 502         | 60                   | 709     | 65                   |
| 1902.....  | 786     | 81                   | 680          | 75                   | 426          | 44                   | 556         | 42                   | 745     | 96                   |
| 1903.....  | 766     | 71                   | 654          | 72                   | 447          | 47                   | 562         | 60                   | 773     | 76                   |
| 1904.....  | 753     | 58                   | 639          | 88                   | 435          | 63                   | 605         | 56                   | 765     | 77                   |
| 1905.....  | 749     | 93                   | 584          | 65                   | 453          | 57                   | 598         | 59                   | 767     | 82                   |
| 1906.....  | 782     | 78                   | 552          | 54                   | 446          | 44                   | 654         | 52                   | 850     | 96                   |
| 1907.....  | 841     | 78                   | 545          | 61                   | 452          | 49                   | 700         | 83                   | 832     | 94                   |
| Total..... | 7,800   | 880                  | 6,397        | 777                  | 4,263        | 522                  | 5,678       | 616                  | 7,676   | 857                  |

  

| Year.      | Salem.  |                      | Somerville. |                      | Springfield. |                      | Taunton. |                      | Waltham. |                      |
|------------|---------|----------------------|-------------|----------------------|--------------|----------------------|----------|----------------------|----------|----------------------|
|            | Births. | Deaths under 1 year. | Births.     | Deaths under 1 year. | Births.      | Deaths under 1 year. | Births.  | Deaths under 1 year. | Births.  | Deaths under 1 year. |
| 1898.....  | 954     | 128                  | 1,570       | 196                  | 1,584        | 221                  | 772      | 109                  | 500      | 59                   |
| 1899.....  | 932     | 198                  | 1,595       | 171                  | 1,512        | 177                  | 728      | 133                  | 474      | 56                   |
| 1900.....  | 994     | 191                  | 1,570       | 224                  | 1,560        | 258                  | 788      | 161                  | 516      | 64                   |
| 1901.....  | 953     | 148                  | 1,606       | 160                  | 1,449        | 165                  | 835      | 103                  | 486      | 56                   |
| 1902.....  | 937     | 136                  | 1,533       | 160                  | 1,592        | 194                  | 756      | 93                   | 512      | 44                   |
| 1903.....  | 997     | 161                  | 1,670       | 170                  | 1,647        | 199                  | 779      | 118                  | 516      | 56                   |
| 1904.....  | 1,076   | 171                  | 1,625       | 168                  | 1,624        | 213                  | 811      | 126                  | 535      | 47                   |
| 1905.....  | 1,094   | 198                  | 1,637       | 165                  | 1,810        | 202                  | 810      | 162                  | 481      | 39                   |
| 1906.....  | 1,128   | 179                  | 1,769       | 185                  | 1,816        | 220                  | 885      | 142                  | 551      | 55                   |
| 1907.....  | 1,127   | 187                  | 1,805       | 163                  | 2,019        | 234                  | 909      | 129                  | 562      | 53                   |
| Total..... | 10,192  | 1,697                | 16,430      | 1,762                | 16,613       | 2,083                | 8,073    | 1,266                | 5,133    | 529                  |

  

| Year.      | Woburn. |                      | Worcester. |                      | Total for 32 cities. |                      | The State. |                      |
|------------|---------|----------------------|------------|----------------------|----------------------|----------------------|------------|----------------------|
|            | Births. | Deaths under 1 year. | Births.    | Deaths under 1 year. | Births.              | Deaths under 1 year. | Births.    | Deaths under 1 year. |
| 1898.....  | 362     | 59                   | 3,080      | 442                  | 53,345               | 8,376                | 73,110     | 11,012               |
| 1899.....  | 363     | 54                   | 3,070      | 422                  | 51,350               | 8,014                | 70,457     | 10,532               |
| 1900.....  | 379     | 55                   | 3,131      | 513                  | 53,700               | 8,615                | 73,386     | 11,500               |
| 1901.....  | 292     | 44                   | 3,291      | 419                  | 52,353               | 7,552                | 71,976     | 9,952                |
| 1902.....  | 352     | 54                   | 3,349      | 434                  | 52,401               | 7,745                | 72,219     | 10,075               |
| 1903.....  | 330     | 40                   | 3,501      | 474                  | 53,459               | 7,872                | 73,584     | 10,269               |
| 1904.....  | 309     | 43                   | 3,540      | 418                  | 54,076               | 7,570                | 75,014     | 9,992                |
| 1905.....  | 312     | 35                   | 3,510      | 503                  | 53,994               | 7,967                | 75,022     | 10,519               |
| 1906.....  | 303     | 51                   | 3,743      | 526                  | 58,110               | 8,439                | 80,237     | 11,106               |
| 1907.....  | 334     | 51                   | 3,998      | 535                  | 61,862               | 8,514                | 85,001     | 11,293               |
| Total..... | 3,336   | 486                  | 34,213     | 4,691                | 544,650              | 80,644               | 750,006    | 106,250              |

TABLE II.—FEMALE POPULATION 10 YEARS OF AGE AND OVER EMPLOYED IN GAINFUL OCCUPATIONS (DOMESTIC SERVICE NOT INCLUDED) IN 32 CITIES OF MASSACHUSETTS, BY OCCUPATIONS, 1885 AND 1905.

[Compiled from Census of Massachusetts, 1885 and 1905.]

| City and year.   | Number of females 10 years of age and over in each occupation or industry. |                               |                           |        |                           |                   |                        |                         |                     |                        | Total. |                                                     |
|------------------|----------------------------------------------------------------------------|-------------------------------|---------------------------|--------|---------------------------|-------------------|------------------------|-------------------------|---------------------|------------------------|--------|-----------------------------------------------------|
|                  | Gov-<br>ern-<br>ment.                                                      | Profes-<br>sional<br>service. | Per-<br>sonal<br>service. | Trade. | Trans-<br>porta-<br>tion. | Agricul-<br>ture. | The<br>fish-<br>eries. | Manu-<br>fac-<br>tures. | La-<br>bor-<br>ers. | Ap-<br>pren-<br>tices. |        | Child-<br>ren at<br>work<br>(10 to<br>15<br>years). |
| 1885.            |                                                                            |                               |                           |        |                           |                   |                        |                         |                     |                        |        |                                                     |
| Beverly.....     | 1                                                                          | 64                            | 37                        | 32     | 1                         |                   |                        | 514                     |                     |                        | 1      | 650                                                 |
| Boston.....      | 457                                                                        | 2,899                         | 4,060                     | 5,204  | 51                        | 9                 |                        | 16,048                  | 4                   | 223                    | 148    | 29,103                                              |
| Brockton.....    | 4                                                                          | 116                           | 72                        | 117    | 1                         | 1                 |                        | 1,269                   | 1                   | 4                      | 8      | 1,593                                               |
| Cambridge.....   | 32                                                                         | 441                           | 460                       | 487    | 26                        | 7                 |                        | 2,325                   |                     | 27                     | 13     | 3,818                                               |
| Chelsea.....     | 6                                                                          | 172                           | 140                       | 272    | 3                         |                   |                        | 818                     |                     |                        | 4      | 1,415                                               |
| Chicopee.....    |                                                                            | 58                            | 44                        | 30     |                           |                   |                        | 1,509                   |                     | 4                      | 9      | 1,654                                               |
| Everett.....     | 1                                                                          | 36                            | 10                        | 39     | 2                         |                   |                        | 137                     |                     |                        | 1      | 226                                                 |
| Fall River.....  | 3                                                                          | 264                           | 238                       | 141    |                           | 1                 |                        | 7,982                   | 1                   | 12                     | 134    | 8,776                                               |
| Fitchburg.....   | 9                                                                          | 101                           | 32                        | 69     |                           |                   |                        | 894                     |                     | 3                      | 6      | 1,114                                               |
| Gloucester.....  | 8                                                                          | 141                           | 76                        | 80     |                           |                   | 7                      | 354                     |                     | 4                      | 6      | 676                                                 |
| Haverhill.....   | 1                                                                          | 156                           | 106                       | 143    |                           |                   |                        | 1,739                   | 1                   | 8                      | 7      | 2,161                                               |
| Holyoke.....     |                                                                            | 143                           | 84                        | 90     |                           | 6                 |                        | 3,973                   |                     | 2                      | 25     | 4,328                                               |
| Lawrence.....    | 10                                                                         | 200                           | 159                       | 229    | 3                         | 3                 |                        | 5,392                   | 8                   | 14                     | 27     | 6,045                                               |
| Lowell.....      | 14                                                                         | 391                           | 284                       | 388    | 1                         | 1                 |                        | 10,076                  | 1                   | 8                      | 111    | 11,275                                              |
| Lynn.....        | 17                                                                         | 280                           | 230                       | 384    | 4                         | 1                 |                        | 4,055                   |                     | 3                      | 8      | 4,982                                               |
| Malden.....      | 14                                                                         | 148                           | 146                       | 120    |                           |                   |                        | 852                     |                     | 2                      | 6      | 1,288                                               |
| Marlboro.....    | 2                                                                          | 61                            | 29                        | 30     |                           | 1                 |                        | 812                     |                     | 5                      | 4      | 944                                                 |
| Medford.....     | 6                                                                          | 60                            | 35                        | 76     | 1                         |                   |                        | 253                     |                     | 2                      |        | 433                                                 |
| New Bedford..... | 10                                                                         | 217                           | 184                       | 187    | 2                         |                   |                        | 2,739                   | 5                   | 7                      | 58     | 3,409                                               |
| Newburyport..... | 2                                                                          | 115                           | 72                        | 84     |                           |                   |                        | 972                     |                     |                        | 10     | 1,255                                               |
| Newton.....      | 14                                                                         | 228                           | 95                        | 75     | 4                         | 1                 |                        | 563                     | 1                   | 6                      | 9      | 996                                                 |
| North Adams..... |                                                                            | 55                            | 23                        | 27     |                           | 2                 |                        | 1,040                   |                     |                        | 11     | 1,158                                               |
| Northampton..... | 47                                                                         | 114                           | 29                        | 47     | 2                         | 4                 |                        | 877                     |                     | 2                      | 4      | 1,126                                               |
| Pittsfield.....  | 3                                                                          | 104                           | 44                        | 78     |                           | 7                 |                        | 953                     |                     | 2                      | 9      | 1,200                                               |
| Quincy.....      | 4                                                                          | 90                            | 40                        | 61     | 1                         |                   |                        | 193                     |                     | 5                      | 1      | 395                                                 |
| Salem.....       | 23                                                                         | 226                           | 212                       | 252    | 5                         | 1                 |                        | 1,713                   |                     | 6                      | 31     | 2,468                                               |
| Somerville.....  | 7                                                                          | 202                           | 194                       | 303    | 5                         |                   |                        | 740                     |                     | 16                     | 7      | 1,474                                               |
| Springfield..... | 15                                                                         | 282                           | 259                       | 258    | 1                         |                   |                        | 1,905                   |                     | 14                     | 15     | 2,749                                               |
| Taunton.....     | 55                                                                         | 110                           | 61                        | 97     |                           |                   |                        | 1,515                   | 1                   | 8                      | 26     | 1,873                                               |
| Waltham.....     | 5                                                                          | 82                            | 41                        | 92     | 3                         | 1                 |                        | 1,495                   |                     | 2                      | 13     | 1,734                                               |
| Woburn.....      | 4                                                                          | 90                            | 25                        | 42     | 1                         |                   |                        | 418                     |                     |                        | 2      | 582                                                 |
| Worcester.....   | 127                                                                        | 496                           | 261                       | 385    |                           | 7                 |                        | 2,772                   | 1                   | 25                     | 9      | 4,083                                               |
| The State.....   | 1,311                                                                      | 14,250                        | 9,788                     | 11,837 | 143                       | 404               | 7                      | 112,762                 | 31                  | 495                    | 1,133  | 152,161                                             |
| 1905.            |                                                                            |                               |                           |        |                           |                   |                        |                         |                     |                        |        |                                                     |
| Beverly.....     | 12                                                                         | 143                           | 218                       | 218    | 5                         | 1                 |                        | 542                     |                     | 4                      | 13     | 1,156                                               |
| Boston.....      | 909                                                                        | 5,727                         | 13,310                    | 14,756 | 175                       | 14                | 1                      | 23,170                  | 81                  | 222                    | 1,496  | 59,861                                              |
| Brockton.....    | 29                                                                         | 311                           | 505                       | 759    | 5                         | 2                 |                        | 3,660                   |                     | 13                     | 92     | 5,376                                               |
| Cambridge.....   | 103                                                                        | 1,023                         | 2,188                     | 1,785  | 27                        | 3                 |                        | 4,267                   | 3                   | 48                     | 226    | 9,673                                               |
| Chelsea.....     | 32                                                                         | 269                           | 437                       | 692    | 19                        | 1                 |                        | 1,573                   |                     | 3                      | 91     | 3,117                                               |
| Chicopee.....    | 11                                                                         | 117                           | 97                        | 184    |                           | 1                 |                        | 2,006                   |                     | 4                      | 116    | 2,536                                               |
| Everett.....     | 15                                                                         | 244                           | 448                       | 645    | 5                         | 1                 |                        | 914                     |                     | 10                     | 37     | 2,519                                               |
| Fall River.....  | 34                                                                         | 724                           | 697                       | 826    | 5                         | 5                 |                        | 13,552                  |                     | 50                     | 946    | 16,839                                              |
| Fitchburg.....   | 25                                                                         | 304                           | 333                       | 379    | 5                         | 5                 |                        | 2,201                   |                     | 4                      | 160    | 3,416                                               |
| Gloucester.....  | 14                                                                         | 214                           | 314                       | 307    | 7                         | 4                 |                        | 627                     | 1                   | 5                      | 29     | 1,522                                               |
| Haverhill.....   | 31                                                                         | 328                           | 403                       | 586    | 4                         | 3                 |                        | 2,914                   |                     | 10                     | 55     | 4,334                                               |
| Holyoke.....     | 17                                                                         | 443                           | 458                       | 471    | 3                         | 2                 |                        | 5,344                   |                     | 20                     | 368    | 7,126                                               |
| Lawrence.....    | 33                                                                         | 407                           | 445                       | 839    | 4                         | 2                 |                        | 8,356                   |                     | 24                     | 555    | 10,665                                              |
| Lowell.....      | 44                                                                         | 696                           | 894                       | 1,334  | 21                        |                   |                        | 11,641                  |                     | 18                     | 567    | 15,215                                              |
| Lynn.....        | 40                                                                         | 555                           | 1,034                     | 1,339  | 24                        | 6                 |                        | 6,189                   |                     | 26                     | 171    | 9,384                                               |
| Malden.....      | 38                                                                         | 397                           | 621                       | 735    | 11                        | 1                 |                        | 1,827                   |                     | 13                     | 42     | 3,685                                               |
| Marlboro.....    | 5                                                                          | 131                           | 94                        | 109    | 2                         | 5                 |                        | 1,218                   |                     | 5                      | 65     | 1,694                                               |
| Medford.....     | 16                                                                         | 199                           | 267                       | 406    | 7                         | 1                 |                        | 495                     |                     | 3                      | 18     | 1,412                                               |
| New Bedford..... | 40                                                                         | 456                           | 697                       | 707    | 7                         |                   |                        | 7,445                   | 40                  | 551                    | 9,943  |                                                     |
| Newburyport..... | 6                                                                          | 144                           | 225                       | 176    | 1                         | 1                 | 2                      | 922                     |                     | 2                      | 19     | 1,498                                               |
| Newton.....      | 47                                                                         | 503                           | 787                       | 414    | 10                        | 5                 |                        | 990                     | 5                   | 7                      | 54     | 2,822                                               |
| North Adams..... | 12                                                                         | 184                           | 241                       | 198    | 2                         | 2                 |                        | 1,775                   |                     | 16                     | 121    | 2,551                                               |
| Northampton..... | 85                                                                         | 282                           | 385                       | 208    |                           | 1                 |                        | 1,178                   |                     | 10                     | 64     | 2,213                                               |
| Pittsfield.....  | 12                                                                         | 198                           | 391                       | 333    |                           | 5                 |                        | 1,650                   |                     | 15                     | 92     | 2,696                                               |
| Quincy.....      | 16                                                                         | 250                           | 317                       | 351    | 6                         |                   |                        | 662                     |                     | 13                     | 25     | 1,640                                               |
| Salem.....       | 55                                                                         | 375                           | 565                       | 596    | 10                        | 1                 |                        | 2,146                   |                     | 12                     | 152    | 3,912                                               |
| Somerville.....  | 92                                                                         | 645                           | 1,138                     | 1,605  | 46                        | 2                 |                        | 2,169                   |                     | 33                     | 101    | 5,831                                               |
| Springfield..... | 71                                                                         | 759                           | 1,374                     | 1,386  | 13                        | 2                 |                        | 3,453                   |                     | 36                     | 200    | 7,294                                               |
| Taunton.....     | 140                                                                        | 216                           | 327                       | 280    | 5                         |                   |                        | 1,852                   |                     | 7                      | 98     | 2,925                                               |
| Waltham.....     | 110                                                                        | 311                           | 467                       | 369    | 13                        | 6                 |                        | 2,547                   | 1                   | 7                      | 29     | 3,860                                               |
| Woburn.....      | 10                                                                         | 151                           | 211                       | 193    | 6                         | 4                 |                        | 463                     | 5                   | 2                      | 16     | 1,061                                               |
| Worcester.....   | 426                                                                        | 1,226                         | 1,713                     | 1,993  | 8                         | 3                 |                        | 5,670                   | 1                   | 50                     | 322    | 11,412                                              |
| The State.....   | 3,981                                                                      | 27,011                        | 41,896                    | 43,183 | 652                       | 895               | 3                      | 170,729                 | 156                 | 938                    | 9,247  | 298,691                                             |



TABLE III.—SUMMARY OF BIRTHS AND SUMMARY OF DEATHS FROM SPECIFIED IN 11 NEW ENGLAND TEXTILE

[Compiled by the Bureau

| Locality and year. | Births. | Deaths from all causes. |               | Disease of early infancy and congenital malformation. |               | Diarrhea, enteritis, and gastritis. |               | Convulsions.  |               |
|--------------------|---------|-------------------------|---------------|-------------------------------------------------------|---------------|-------------------------------------|---------------|---------------|---------------|
|                    |         | Under 1 year.           | 1 to 4 years. | Under 1 year.                                         | 1 to 4 years. | Under 1 year.                       | 1 to 4 years. | Under 1 year. | 1 to 4 years. |
| Biddeford, Me.:    |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....          | 534     | 121                     | 38            | 38                                                    | .....         | 40                                  | 7             | 5             | 1             |
| 1901.....          | 553     | 116                     | 20            | 19                                                    | .....         | 44                                  | 2             | 3             | .....         |
| 1902.....          | 532     | 115                     | 51            | 25                                                    | .....         | 39                                  | 5             | 5             | .....         |
| 1903.....          | 526     | 98                      | 37            | 31                                                    | .....         | 18                                  | 2             | 4             | 1             |
| 1904.....          | 516     | 98                      | 29            | 42                                                    | .....         | 16                                  | 3             | 3             | 1             |
| 1905.....          | 531     | 89                      | 27            | 34                                                    | .....         | 19                                  | 1             | 5             | 2             |
| 1906.....          | 551     | 102                     | 43            | 26                                                    | .....         | 32                                  | 4             | 2             | 2             |
| 1907.....          | 546     | 90                      | 35            | 25                                                    | .....         | 21                                  | 1             | 4             | 2             |
| Total .....        | 4,289   | 829                     | 280           | 240                                                   | .....         | 229                                 | 25            | 31            | 14            |
| Lewiston, Me.:     |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....          | (b)     | (b)                     | (b)           | (b)                                                   | (b)           | (b)                                 | (b)           | (b)           | (b)           |
| 1901.....          | (b)     | (b)                     | (b)           | (b)                                                   | (b)           | (b)                                 | (b)           | (b)           | (b)           |
| 1902.....          | (b)     | (b)                     | (b)           | (b)                                                   | (b)           | (b)                                 | (b)           | (b)           | (b)           |
| 1903.....          | (b)     | (b)                     | (b)           | (b)                                                   | (b)           | (b)                                 | (b)           | (b)           | (b)           |
| 1904.....          | (b)     | (b)                     | (b)           | (b)                                                   | (b)           | (b)                                 | (b)           | (b)           | (b)           |
| 1905.....          | (b)     | (b)                     | (b)           | (b)                                                   | (b)           | (b)                                 | (b)           | (b)           | (b)           |
| 1906.....          | 569     | 146                     | 62            | 29                                                    | .....         | 39                                  | 12            | 3             | 1             |
| 1907.....          | 485     | 129                     | 38            | 24                                                    | .....         | 50                                  | 6             | 3             | 2             |
| Total .....        | 1,054   | 275                     | 100           | 53                                                    | .....         | 89                                  | 18            | 6             | 3             |
| Chicopee, Mass.:   |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....          | 752     | 159                     | 55            | 32                                                    | 1             | 52                                  | 13            | 8             | 1             |
| 1901.....          | 729     | 120                     | 44            | 41                                                    | 1             | 22                                  | 4             | 11            | .....         |
| 1902.....          | 787     | 143                     | 66            | 39                                                    | 2             | 38                                  | 14            | 6             | 1             |
| 1903.....          | 755     | 137                     | 69            | 35                                                    | .....         | 34                                  | 7             | 5             | 5             |
| 1904.....          | 766     | 109                     | 31            | 25                                                    | .....         | 32                                  | 7             | 6             | 1             |
| 1905.....          | 726     | 124                     | 42            | 25                                                    | .....         | 39                                  | 10            | 12            | 1             |
| 1906.....          | 805     | 138                     | 40            | 38                                                    | .....         | 40                                  | 7             | 10            | 1             |
| 1907.....          | 836     | 155                     | 81            | 49                                                    | 2             | 42                                  | 14            | 13            | 3             |
| Total .....        | 6,156   | 1,085                   | 428           | 284                                                   | 6             | 299                                 | 76            | 71            | 13            |
| Fall River, Mass.: |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....          | 4,327   | 885                     | 280           | 244                                                   | .....         | 296                                 | 47            | 48            | 22            |
| 1901.....          | 4,054   | 728                     | 191           | 218                                                   | .....         | 266                                 | 42            | 31            | 12            |
| 1902.....          | 4,341   | 893                     | 344           | 250                                                   | .....         | 266                                 | 57            | 41            | 11            |
| 1903.....          | 4,448   | 864                     | 293           | 266                                                   | 1             | 287                                 | 49            | 35            | 14            |
| 1904.....          | 4,514   | 806                     | 175           | 267                                                   | .....         | 270                                 | 28            | 42            | 9             |
| 1905.....          | 4,092   | 846                     | 271           | 202                                                   | .....         | 312                                 | 54            | 37            | 11            |
| 1906.....          | 4,333   | 812                     | 249           | 205                                                   | 1             | 292                                 | 57            | 35            | 8             |
| 1907.....          | 4,622   | 899                     | 316           | 213                                                   | 1             | 395                                 | 78            | 30            | 10            |
| Total .....        | 34,731  | 6,733                   | 2,119         | 1,865                                                 | 3             | 2,384                               | 412           | 299           | 97            |
| Holyoke, Mass.:    |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....          | 1,663   | 296                     | 171           | 51                                                    | .....         | 117                                 | 21            | 5             | 2             |
| 1901.....          | 1,634   | 286                     | 100           | 65                                                    | .....         | 80                                  | 11            | 9             | 2             |
| 1902.....          | 1,500   | 247                     | 76            | 72                                                    | .....         | 79                                  | 16            | 5             | 1             |
| 1903.....          | 1,512   | 312                     | 106           | 85                                                    | 1             | 109                                 | 8             | 5             | 3             |
| 1904.....          | 1,463   | 280                     | 59            | 77                                                    | .....         | 105                                 | 8             | 3             | 4             |
| 1905.....          | 1,514   | 259                     | 91            | 68                                                    | .....         | 72                                  | 10            | 5             | 1             |
| 1906.....          | 1,570   | 314                     | 97            | 102                                                   | .....         | 83                                  | 12            | 6             | 3             |
| 1907.....          | 1,610   | 327                     | 129           | 102                                                   | 1             | 87                                  | 14            | 6             | .....         |
| Total .....        | 12,466  | 2,321                   | 829           | 622                                                   | 3             | 732                                 | 100           | 44            | 16            |
| Lawrence, Mass.:   |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....          | 2,102   | 400                     | 138           | 83                                                    | 1             | 159                                 | 31            | 18            | 1             |
| 1901.....          | 1,921   | 346                     | 95            | 68                                                    | .....         | 121                                 | 18            | 23            | 6             |
| 1902.....          | 1,958   | 351                     | 148           | 64                                                    | .....         | 99                                  | 20            | 19            | 7             |
| 1903.....          | 2,045   | 348                     | 119           | 58                                                    | 1             | 134                                 | 18            | 13            | 2             |
| 1904.....          | 2,047   | 320                     | 104           | 73                                                    | 2             | 111                                 | 16            | 13            | 2             |
| 1905.....          | 2,089   | 413                     | 167           | 83                                                    | .....         | 170                                 | 33            | 15            | 6             |
| 1906.....          | 2,409   | 429                     | 182           | 87                                                    | 2             | 159                                 | 22            | 23            | 11            |
| 1907.....          | 2,761   | 405                     | 151           | 72                                                    | 1             | 158                                 | 29            | 19            | 1             |
| Total .....        | 17,332  | 3,012                   | 1,104         | 588                                                   | 8             | 1,111                               | 187           | 143           | 36            |

\* Not including broncho-pneumonia.

CAUSES OF CHILDREN UNDER 1 AND FROM 1 TO 4 YEARS OF AGE, INCLUSIVE TOWNS, 1900 TO 1907.

of the Census.]

| Nontuberculous meningitis. |               | Pneumonia, bronchitis, and laryngitis.* |               | Tuberculosis (all forms). |               | Whooping cough. |               | Measles.      |               | All other causes. |               |
|----------------------------|---------------|-----------------------------------------|---------------|---------------------------|---------------|-----------------|---------------|---------------|---------------|-------------------|---------------|
| Under 1 year.              | 1 to 4 years. | Under 1 year.                           | 1 to 4 years. | Under 1 year.             | 1 to 4 years. | Under 1 year.   | 1 to 4 years. | Under 1 year. | 1 to 4 years. | Under 1 year.     | 1 to 4 years. |
| 5                          | 7             | 8                                       | 8             | 1                         | 1             | 2               | .....         | .....         | .....         | 22                | 14            |
| 8                          | 2             | 13                                      | 5             | .....                     | .....         | .....           | 1             | .....         | .....         | 32                | 9             |
| 8                          | 11            | 15                                      | 15            | 1                         | .....         | .....           | .....         | 1             | 1             | 21                | 15            |
| 10                         | 6             | 9                                       | 9             | .....                     | 2             | 9               | 6             | .....         | .....         | 17                | 11            |
| 8                          | 4             | 11                                      | 7             | .....                     | 4             | 2               | .....         | .....         | .....         | 16                | 10            |
| 5                          | 5             | 9                                       | 4             | 2                         | 1             | 1               | .....         | .....         | .....         | 14                | 14            |
| 11                         | 9             | 14                                      | 14            | 4                         | 1             | .....           | 1             | 2             | 2             | 11                | 10            |
| 8                          | 14            | 16                                      | 3             | 3                         | 2             | .....           | 1             | .....         | .....         | 13                | 12            |
| 60                         | 58            | 95                                      | 65            | 11                        | 11            | 14              | 9             | 3             | 3             | 146               | 95            |
| (b)                        | (b)           | (b)                                     | (b)           | (b)                       | (b)           | (b)             | (b)           | (b)           | (b)           | (b)               | (b)           |
| (b)                        | (b)           | (b)                                     | (b)           | (b)                       | (b)           | (b)             | (b)           | (b)           | (b)           | (b)               | (b)           |
| (b)                        | (b)           | (b)                                     | (b)           | (b)                       | (b)           | (b)             | (b)           | (b)           | (b)           | (b)               | (b)           |
| (b)                        | (b)           | (b)                                     | (b)           | (b)                       | (b)           | (b)             | (b)           | (b)           | (b)           | (b)               | (b)           |
| (b)                        | (b)           | (b)                                     | (b)           | (b)                       | (b)           | (b)             | (b)           | (b)           | (b)           | (b)               | (b)           |
| (b)                        | (b)           | (b)                                     | (b)           | (b)                       | (b)           | (b)             | (b)           | (b)           | (b)           | (b)               | (b)           |
| 8                          | 5             | 10                                      | 9             | .....                     | 1             | 1               | .....         | 6             | 10            | 50                | 24            |
| 9                          | 7             | 8                                       | 3             | 6                         | 2             | 1               | .....         | .....         | .....         | 28                | 18            |
| 17                         | 12            | 18                                      | 12            | 6                         | 3             | 2               | .....         | 6             | 10            | 78                | 42            |
| 13                         | 7             | 27                                      | 14            | 2                         | 6             | 2               | .....         | .....         | 1             | 23                | 12            |
| 14                         | 6             | 8                                       | 6             | 1                         | 4             | 3               | 6             | .....         | .....         | 20                | 17            |
| 16                         | 5             | 12                                      | 8             | 1                         | 1             | 1               | .....         | .....         | 2             | 30                | 33            |
| 8                          | 6             | 19                                      | 9             | 1                         | 1             | 3               | 2             | 1             | 1             | 31                | 38            |
| 10                         | 6             | 12                                      | 2             | 1                         | 3             | 1               | .....         | .....         | .....         | 21                | 12            |
| 2                          | 4             | 10                                      | 7             | 3                         | 3             | 1               | .....         | .....         | 2             | 32                | 15            |
| 10                         | 5             | 10                                      | 9             | 3                         | .....         | 7               | 2             | .....         | 1             | 20                | 15            |
| 4                          | 6             | 19                                      | 10            | 1                         | 2             | 1               | 1             | 2             | 5             | 24                | 38            |
| 77                         | 45            | 117                                     | 65            | 13                        | 20            | 19              | 11            | 4             | 12            | 201               | 180           |
| 27                         | 28            | 93                                      | 63            | 9                         | 15            | 8               | 5             | 6             | 10            | 154               | 90            |
| 26                         | 25            | 46                                      | 35            | 8                         | 6             | .....           | .....         | 1             | 1             | 132               | 70            |
| 25                         | 26            | 100                                     | 70            | 7                         | 9             | 15              | 9             | 5             | 18            | 184               | 144           |
| 22                         | 19            | 90                                      | 61            | 11                        | 11            | 9               | 2             | 3             | 8             | 141               | 128           |
| 23                         | 19            | 74                                      | 34            | 6                         | 7             | 1               | 1             | 1             | 6             | 122               | 71            |
| 24                         | 15            | 115                                     | 68            | 9                         | 16            | 14              | 12            | 7             | 23            | 126               | 72            |
| 21                         | 19            | 94                                      | 50            | 7                         | 7             | 11              | 10            | 4             | 7             | 143               | 90            |
| 10                         | 24            | 94                                      | 68            | 6                         | 15            | 10              | 5             | .....         | 16            | 141               | 99            |
| 178                        | 175           | 706                                     | 449           | 63                        | 86            | 68              | 44            | 27            | 89            | 1,143             | 764           |
| 24                         | 15            | 28                                      | 18            | 3                         | 4             | 1               | 1             | 7             | 15            | 60                | 95            |
| 25                         | 13            | 23                                      | 17            | .....                     | 6             | 8               | 11            | .....         | .....         | 76                | 40            |
| 11                         | 5             | 11                                      | 6             | 6                         | .....         | .....           | .....         | 2             | 1             | 61                | 40            |
| 10                         | 12            | 35                                      | 18            | 5                         | 10            | 9               | 2             | 8             | 8             | 46                | 44            |
| 15                         | 6             | 30                                      | 7             | 6                         | 5             | 2               | 3             | .....         | .....         | 42                | 26            |
| 14                         | 16            | 21                                      | 9             | 5                         | 6             | 4               | 1             | 1             | 5             | 69                | 43            |
| 14                         | 12            | 15                                      | 13            | 2                         | 9             | 26              | 8             | .....         | 3             | 66                | 37            |
| 18                         | 12            | 20                                      | 20            | 2                         | 2             | 5               | .....         | 3             | 3             | 84                | 77            |
| 131                        | 91            | 183                                     | 108           | 29                        | 48            | 55              | 26            | 21            | 35            | 504               | 402           |
| 15                         | 8             | 31                                      | 21            | 4                         | 3             | 3               | 3             | 8             | 12            | 79                | 58            |
| 25                         | 13            | 34                                      | 16            | 4                         | 7             | 2               | 1             | 1             | .....         | 68                | 34            |
| 31                         | 6             | 53                                      | 34            | 3                         | 10            | 10              | 8             | 3             | 11            | 69                | 51            |
| 23                         | 6             | 29                                      | 16            | 7                         | 7             | 8               | 3             | 3             | 6             | 73                | 30            |
| 13                         | 15            | 38                                      | 24            | 7                         | 5             | 4               | 1             | 1             | .....         | 60                | 39            |
| 19                         | 20            | 34                                      | 31            | 3                         | 7             | .....           | 1             | 8             | 15            | 81                | 54            |
| 11                         | 24            | 48                                      | 29            | 6                         | 7             | 19              | 13            | 1             | 11            | 75                | 63            |
| 16                         | 11            | 36                                      | 21            | 4                         | 6             | 6               | 2             | 4             | 8             | 90                | 72            |
| 153                        | 103           | 303                                     | 192           | 38                        | 52            | 52              | 32            | 29            | 63            | 595               | 431           |

\* Not separately reported.



TABLE III.—SUMMARY OF BIRTHS AND SUMMARY OF DEATHS FROM SPECIFIED IN 11 NEW ENGLAND TEXTILE

| Locality and year.  | Births. | Deaths from all causes. |               | Disease of early infancy and congenital malformation. |               | Diarrhea, enteritis, and gastritis. |               | Convulsions.  |               |
|---------------------|---------|-------------------------|---------------|-------------------------------------------------------|---------------|-------------------------------------|---------------|---------------|---------------|
|                     |         | Under 1 year.           | 1 to 4 years. | Under 1 year.                                         | 1 to 4 years. | Under 1 year.                       | 1 to 4 years. | Under 1 year. | 1 to 4 years. |
| Lowell, Mass.:      |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....           | 2,596   | 525                     | 166           | 140                                                   | 2             | 178                                 | 26            | 26            | 14            |
| 1901.....           | 2,794   | 544                     | 261           | 155                                                   | 1             | 164                                 | 26            | 33            | 7             |
| 1902.....           | 2,493   | 523                     | 219           | 160                                                   | .....         | 170                                 | 18            | 29            | 6             |
| 1903.....           | 2,519   | 557                     | 182           | 143                                                   | .....         | 219                                 | 26            | 23            | 4             |
| 1904.....           | 2,519   | 499                     | 175           | 143                                                   | .....         | 190                                 | 34            | 10            | 7             |
| 1905.....           | 2,500   | 496                     | 194           | 119                                                   | .....         | 220                                 | 39            | 21            | 10            |
| 1906.....           | 2,547   | 545                     | 208           | 124                                                   | .....         | 215                                 | 34            | 20            | 8             |
| 1907.....           | 2,704   | 535                     | 163           | 151                                                   | 1             | 211                                 | 29            | 20            | 2             |
| Total .....         | 20,672  | 4,224                   | 1,568         | 1,135                                                 | 4             | 1,567                               | 232           | 182           | 58            |
| New Bedford, Mass.: |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....           | 2,230   | 435                     | 138           | 131                                                   | .....         | 162                                 | 21            | 23            | 7             |
| 1901.....           | 2,440   | 362                     | 131           | 108                                                   | .....         | 127                                 | 8             | 16            | 8             |
| 1902.....           | 2,437   | 446                     | 154           | 126                                                   | 1             | 151                                 | 14            | 20            | 5             |
| 1903.....           | 2,469   | 448                     | 280           | 117                                                   | 2             | 162                                 | 24            | 15            | 14            |
| 1904.....           | 2,620   | 440                     | 111           | 125                                                   | .....         | 169                                 | 17            | 25            | 7             |
| 1905.....           | 2,765   | 417                     | 115           | 125                                                   | 1             | 136                                 | 19            | 21            | 7             |
| 1906.....           | 2,949   | 461                     | 154           | 145                                                   | .....         | 176                                 | 17            | 24            | 7             |
| 1907.....           | 3,272   | 538                     | 125           | 128                                                   | .....         | 218                                 | 19            | 26            | 5             |
| Total .....         | 21,182  | 3,547                   | 1,208         | 1,005                                                 | 4             | 1,301                               | 139           | 170           | 60            |
| Manchester, N. H.:  |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....           | 1,655   | 360                     | 133           | 92                                                    | .....         | 134                                 | 20            | 24            | 6             |
| 1901.....           | 1,359   | 331                     | 100           | 46                                                    | .....         | 129                                 | 14            | 11            | 4             |
| 1902.....           | 1,565   | 360                     | 135           | 50                                                    | .....         | 115                                 | 11            | 14            | 9             |
| 1903.....           | 1,457   | 307                     | 142           | 49                                                    | .....         | 117                                 | 26            | 14            | 8             |
| 1904.....           | 1,434   | 298                     | 82            | 74                                                    | .....         | 99                                  | 13            | 9             | 2             |
| 1905.....           | 1,577   | 356                     | 190           | 89                                                    | .....         | 132                                 | 19            | 6             | 8             |
| 1906.....           | 1,711   | 364                     | 139           | 123                                                   | .....         | 97                                  | 10            | 7             | 2             |
| 1907.....           | 1,781   | 398                     | 117           | 141                                                   | .....         | 102                                 | 9             | 15            | 3             |
| Total .....         | 12,539  | 2,774                   | 1,038         | 664                                                   | .....         | 925                                 | 122           | 100           | 42            |
| Pawtucket, R. I.:   |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....           | 1,025   | 188                     | 86            | 30                                                    | .....         | 61                                  | 11            | 3             | .....         |
| 1901.....           | 1,019   | 147                     | 45            | 38                                                    | .....         | 49                                  | 3             | 3             | .....         |
| 1902.....           | 959     | 175                     | 61            | 24                                                    | .....         | 44                                  | 10            | 2             | 3             |
| 1903.....           | 1,034   | 157                     | 66            | 36                                                    | 2             | 49                                  | 17            | 3             | 2             |
| 1904.....           | 1,064   | 156                     | 45            | 33                                                    | .....         | 35                                  | 10            | 5             | .....         |
| 1905.....           | 1,110   | 164                     | 57            | 35                                                    | .....         | 54                                  | 6             | 2             | .....         |
| 1906.....           | 1,058   | 155                     | 62            | 35                                                    | .....         | 47                                  | 12            | 2             | .....         |
| 1907.....           | 947     | 181                     | 61            | 37                                                    | .....         | 63                                  | 11            | 3             | 1             |
| Total .....         | 8,216   | 1,323                   | 483           | 268                                                   | 2             | 402                                 | 80            | 23            | 6             |
| Woonsocket, R. I.:  |         |                         |               |                                                       |               |                                     |               |               |               |
| 1900.....           | 960     | 210                     | 73            | 29                                                    | 1             | 107                                 | 18            | 5             | 3             |
| 1901.....           | 988     | 160                     | 66            | 47                                                    | .....         | 74                                  | 11            | 2             | 1             |
| 1902.....           | 1,006   | 179                     | 73            | 39                                                    | .....         | 66                                  | 9             | 1             | 3             |
| 1903.....           | 1,006   | 136                     | 70            | 30                                                    | .....         | 45                                  | 13            | 1             | .....         |
| 1904.....           | 1,035   | 125                     | 39            | 29                                                    | 1             | 41                                  | 4             | 2             | 1             |
| 1905.....           | 1,058   | 150                     | 68            | 33                                                    | .....         | 73                                  | 13            | 1             | .....         |
| 1906.....           | 1,093   | 188                     | 57            | 44                                                    | .....         | 78                                  | 10            | 4             | .....         |
| 1907.....           | 1,082   | 139                     | 43            | 28                                                    | .....         | 75                                  | 6             | 3             | 1             |
| Total .....         | 8,228   | 1,287                   | 489           | 279                                                   | 2             | 559                                 | 84            | 19            | 9             |

CAUSES OF CHILDREN UNDER 1 AND FROM 1 TO 4 YEARS OF AGE, INCLUSIVE, TOWNS, 1900 TO 1907—Concluded.

| Nontuberculous meningitis. |               | Pneumonia, bronchitis, and laryngitis. |               | Tuberculosis (all forms). |               | Whooping cough. |               | Measles.      |               | All other causes |               |
|----------------------------|---------------|----------------------------------------|---------------|---------------------------|---------------|-----------------|---------------|---------------|---------------|------------------|---------------|
| Under 1 year.              | 1 to 4 years. | Under 1 year.                          | 1 to 4 years. | Under 1 year.             | 1 to 4 years. | Under 1 year.   | 1 to 4 years. | Under 1 year. | 1 to 4 years. | Under 1 year.    | 1 to 4 years. |
| 21                         | 21            | 69                                     | 48            | 7                         | 6             | .....           | 1             | 1             | .....         | 83               | 48            |
| 29                         | 22            | 51                                     | 42            | 6                         | 6             | 9               | 6             | 2             | 17            | 95               | 134           |
| 26                         | 28            | 57                                     | 39            | 5                         | 7             | 2               | 5             | 3             | 6             | 71               | 110           |
| 24                         | 25            | 46                                     | 44            | 2                         | 6             | 11              | 5             | .....         | 1             | 89               | 71            |
| 19                         | 25            | 59                                     | 41            | 14                        | 7             | 3               | .....         | 9             | 10            | 52               | 51            |
| 16                         | 33            | 45                                     | 33            | 12                        | 21            | 10              | 7             | 3             | 5             | 50               | 46            |
| 16                         | 25            | 79                                     | 55            | 6                         | 6             | 4               | 4             | 5             | 13            | 76               | 63            |
| 6                          | 14            | 63                                     | 33            | 8                         | 4             | 8               | 6             | 1             | 5             | 67               | 69            |
| 157                        | 193           | 469                                    | 335           | 60                        | 63            | 47              | 34            | 24            | 57            | 583              | 592           |
| 18                         | 17            | 34                                     | 33            | 4                         | 6             | 4               | 10            | 7             | 5             | 52               | 39            |
| 12                         | 17            | 41                                     | 37            | 6                         | 12            | .....           | 1             | 3             | 1             | 49               | 47            |
| 16                         | 16            | 51                                     | 34            | 5                         | 7             | 12              | 4             | .....         | 3             | 65               | 70            |
| 17                         | 21            | 50                                     | 40            | 4                         | 14            | 12              | 5             | 2             | 8             | 69               | 152           |
| 9                          | 13            | 31                                     | 16            | 5                         | 7             | 5               | 4             | .....         | 2             | 71               | 45            |
| 10                         | 10            | 37                                     | 19            | 5                         | 9             | 3               | 5             | 1             | .....         | 79               | 45            |
| 10                         | 22            | 39                                     | 24            | 2                         | 24            | 6               | 5             | 2             | 3             | 57               | 52            |
| 17                         | 15            | 62                                     | 25            | 6                         | 11            | 2               | 8             | 1             | 3             | 78               | 39            |
| 109                        | 131           | 345                                    | 228           | 37                        | 90            | 44              | 42            | 16            | 25            | 520              | 489           |
| 20                         | 15            | 24                                     | 31            | 8                         | 9             | 1               | 2             | .....         | .....         | 57               | 50            |
| 26                         | 12            | 27                                     | 17            | 9                         | 8             | 11              | 1             | .....         | .....         | 72               | 44            |
| 25                         | 11            | 66                                     | 33            | 8                         | 6             | 3               | 2             | 2             | 2             | 77               | 61            |
| 10                         | 17            | 39                                     | 29            | 7                         | 4             | 12              | 6             | 1             | .....         | 58               | 52            |
| 17                         | 6             | 33                                     | 18            | 6                         | 7             | 4               | 3             | .....         | .....         | 56               | 33            |
| 33                         | 56            | 22                                     | 17            | 8                         | 9             | 2               | 3             | 2             | 9             | 62               | 69            |
| 26                         | 22            | 31                                     | 22            | 6                         | 6             | 12              | 9             | .....         | .....         | 62               | 68            |
| 14                         | 15            | 30                                     | 21            | 7                         | 6             | 13              | 10            | 2             | 6             | 74               | 47            |
| 171                        | 154           | 272                                    | 188           | 59                        | 55            | 58              | 36            | 7             | 17            | 518              | 424           |
| 11                         | 9             | 17                                     | 10            | 9                         | 8             | 1               | 2             | 2             | 7             | 54               | 39            |
| 12                         | 6             | 10                                     | 6             | .....                     | 2             | .....           | .....         | 1             | 1             | 33               | 27            |
| 20                         | 7             | 24                                     | 14            | 5                         | 3             | 6               | 3             | .....         | 3             | 50               | 18            |
| 10                         | 8             | 18                                     | 9             | 2                         | 3             | 5               | 4             | 2             | 1             | 32               | 20            |
| 8                          | 3             | 20                                     | 7             | 6                         | 2             | .....           | .....         | .....         | 1             | 49               | 22            |
| 2                          | 4             | 14                                     | 10            | 6                         | 4             | 3               | 3             | 1             | 3             | 47               | 27            |
| 7                          | 8             | 18                                     | 8             | 2                         | 7             | 5               | .....         | 1             | 3             | 38               | 24            |
| 3                          | 1             | 20                                     | 12            | 9                         | 8             | 1               | 2             | .....         | 1             | 45               | 25            |
| 73                         | 46            | 143                                    | 76            | 39                        | 37            | 21              | 14            | 6             | 20            | 348              | 202           |
| 11                         | 5             | 13                                     | 10            | 9                         | 1             | 5               | .....         | 1             | 31            | 34               | 34            |
| 2                          | 10            | 8                                      | 8             | 6                         | 6             | 1               | .....         | 3             | 20            | 27               | 27            |
| 5                          | 7             | 21                                     | 14            | 7                         | 3             | 1               | .....         | 1             | 39            | 36               | 36            |
| 1                          | 3             | 21                                     | 9             | 2                         | 2             | 8               | 5             | .....         | 28            | 38               | 38            |
| 5                          | 6             | 14                                     | 11            | 6                         | 1             | 2               | 1             | 2             | 24            | 14               | 14            |
| 3                          | 2             | 10                                     | 14            | 5                         | 9             | 2               | 1             | 3             | 2             | 20               | 27            |
| 2                          | 4             | 26                                     | 10            | 4                         | 3             | 2               | 2             | 1             | 27            | 28               | 28            |
| 1                          | 2             | 8                                      | 6             | 1                         | 4             | 3               | 1             | .....         | 20            | 23               | 23            |
| 30                         | 39            | 121                                    | 82            | 40                        | 29            | 24              | 10            | 6             | 7             | 209              | 227           |

TABLE IV.—SUMMARY OF TOTAL DEATHS (ALL AGES) FROM SPECIFIED

[Compiled by the Bureau

| Locality and year. | All causes. | Diseases of early infancy and congenital malformations. |                           |        | Diarrhea, enteritis, and gastritis. |            |       |
|--------------------|-------------|---------------------------------------------------------|---------------------------|--------|-------------------------------------|------------|-------|
|                    |             | Diseases of early infancy.                              | Congenital malformations. | Total. | Diarrhea and enteritis.             | Gastritis. | Total |
| MAINE.             |             |                                                         |                           |        |                                     |            |       |
| Biddeford:         |             |                                                         |                           |        |                                     |            |       |
| 1900.....          | 366         | 37                                                      | 1                         | 38     | 44                                  | 5          | 49    |
| 1901.....          | 327         | 18                                                      | 1                         | 19     | 50                                  | 3          | 53    |
| 1902.....          | 340         | 26                                                      | .....                     | 26     | 44                                  | .....      | 44    |
| 1903.....          | 306         | 29                                                      | 2                         | 31     | 20                                  | 1          | 21    |
| 1904.....          | 330         | 39                                                      | 2                         | 41     | 21                                  | 2          | 23    |
| 1905.....          | 284         | 33                                                      | 1                         | 34     | 23                                  | 1          | 24    |
| 1906.....          | 332         | 24                                                      | 2                         | 26     | 36                                  | 4          | 40    |
| 1907.....          | 344         | 23                                                      | 2                         | 25     | 22                                  | 1          | 23    |
| Total.....         | 2,629       | 229                                                     | 11                        | 240    | 260                                 | 17         | 277   |
| Lewiston:          |             |                                                         |                           |        |                                     |            |       |
| 1900.....          | (a)         | (a)                                                     | (a)                       | (a)    | (a)                                 | (a)        | (a)   |
| 1901.....          | (a)         | (a)                                                     | (a)                       | (a)    | (a)                                 | (a)        | (a)   |
| 1902.....          | (a)         | (a)                                                     | (a)                       | (a)    | (a)                                 | (a)        | (a)   |
| 1903.....          | (a)         | (a)                                                     | (a)                       | (a)    | (a)                                 | (a)        | (a)   |
| 1904.....          | (a)         | (a)                                                     | (a)                       | (a)    | (a)                                 | (a)        | (a)   |
| 1905.....          | (a)         | (a)                                                     | (a)                       | (a)    | (a)                                 | (a)        | (a)   |
| 1906.....          | 555         | 24                                                      | 5                         | 29     | 53                                  | 2          | 55    |
| 1907.....          | 486         | 24                                                      | .....                     | 24     | 59                                  | .....      | 59    |
| Total.....         | 1,041       | 48                                                      | 5                         | 53     | 112                                 | 2          | 114   |
| MASSACHUSETTS.     |             |                                                         |                           |        |                                     |            |       |
| Chicopee:          |             |                                                         |                           |        |                                     |            |       |
| 1900.....          | 405         | 31                                                      | 1                         | 32     | 71                                  | .....      | 71    |
| 1901.....          | 340         | 40                                                      | 3                         | 43     | 29                                  | 2          | 31    |
| 1902.....          | 398         | 38                                                      | 3                         | 41     | 54                                  | 2          | 56    |
| 1903.....          | 404         | 34                                                      | 1                         | 35     | 43                                  | 6          | 49    |
| 1904.....          | 339         | 23                                                      | 2                         | 25     | 40                                  | 4          | 44    |
| 1905.....          | 356         | 22                                                      | 4                         | 26     | 48                                  | 6          | 54    |
| 1906.....          | 340         | 32                                                      | 5                         | 37     | 51                                  | 2          | 53    |
| 1907.....          | 416         | 45                                                      | 5                         | 50     | 58                                  | 4          | 62    |
| Total.....         | 2,998       | 265                                                     | 24                        | 289    | 394                                 | 26         | 420   |
| Fall River:        |             |                                                         |                           |        |                                     |            |       |
| 1900.....          | 2,286       | 233                                                     | 11                        | 244    | 362                                 | 6          | 368   |
| 1901.....          | 1,979       | 211                                                     | 8                         | 219    | 322                                 | 7          | 329   |
| 1902.....          | 2,206       | 244                                                     | 7                         | 251    | 331                                 | 18         | 349   |
| 1903.....          | 2,342       | 254                                                     | 13                        | 267    | 352                                 | 20         | 372   |
| 1904.....          | 2,074       | 254                                                     | 13                        | 267    | 318                                 | 18         | 336   |
| 1905.....          | 2,109       | 190                                                     | 12                        | 202    | 373                                 | 17         | 390   |
| 1906.....          | 2,089       | 194                                                     | 12                        | 206    | 364                                 | 28         | 392   |
| 1907.....          | 2,384       | 192                                                     | 22                        | 214    | 489                                 | 28         | 517   |
| Total.....         | 17,409      | 1,772                                                   | 98                        | 1,870  | 2,911                               | 142        | 3,053 |
| Holyoke:           |             |                                                         |                           |        |                                     |            |       |
| 1900.....          | 990         | 46                                                      | 5                         | 51     | 142                                 | 6          | 148   |
| 1901.....          | 873         | 58                                                      | 7                         | 65     | 100                                 | 4          | 104   |
| 1902.....          | 769         | 66                                                      | 7                         | 73     | 104                                 | 4          | 108   |
| 1903.....          | 852         | 75                                                      | 8                         | 83     | 122                                 | 8          | 130   |
| 1904.....          | 832         | 69                                                      | 8                         | 77     | 119                                 | 6          | 125   |
| 1905.....          | 823         | 61                                                      | 7                         | 68     | 83                                  | 3          | 86    |
| 1906.....          | 907         | 98                                                      | 5                         | 103    | 99                                  | 3          | 102   |
| 1907.....          | 1,046       | 94                                                      | 9                         | 103    | 101                                 | 4          | 105   |
| Total.....         | 7,092       | 567                                                     | 56                        | 623    | 870                                 | 38         | 908   |
| Lawrence:          |             |                                                         |                           |        |                                     |            |       |
| 1900.....          | 1,290       | 74                                                      | 8                         | 82     | 197                                 | 12         | 209   |
| 1901.....          | 1,130       | 64                                                      | 5                         | 69     | 150                                 | 7          | 157   |
| 1902.....          | 1,168       | 62                                                      | 2                         | 64     | 132                                 | 14         | 146   |
| 1903.....          | 1,144       | 55                                                      | 6                         | 61     | 153                                 | 12         | 165   |
| 1904.....          | 1,147       | 60                                                      | 16                        | 76     | 138                                 | 15         | 153   |
| 1905.....          | 1,384       | 69                                                      | 14                        | 83     | 204                                 | 9          | 213   |
| 1906.....          | 1,345       | 78                                                      | 9                         | 87     | 191                                 | 10         | 201   |
| 1907.....          | 1,450       | 68                                                      | 7                         | 75     | 198                                 | 9          | 207   |
| Total.....         | 10,058      | 530                                                     | 67                        | 597    | 1,363                               | 88         | 1,451 |

a Included in Androscoggin County.

CAUSES IN 11 NEW ENGLAND TEXTILE TOWNS 1900 TO 1907.

of the Census.]

| Convulsions. | Non-tuberculous meningitis. | Pneumonia. | Bronchitis and laryngitis. |             |        | Tuberculosis (all forms). | Whooping cough. | Measles. | All other causes. |
|--------------|-----------------------------|------------|----------------------------|-------------|--------|---------------------------|-----------------|----------|-------------------|
|              |                             |            | Bronchitis.                | Laryngitis. | Total. |                           |                 |          |                   |
| 6            | 17                          | 36         | 5                          | 2           | 7      | 30                        | 2               | —        | 181               |
| 4            | 13                          | 17         | 10                         | 2           | 12     | 39                        | 1               | —        | 169               |
| 9            | 22                          | 34         | 8                          | 6           | 14     | 37                        | —               | 2        | 152               |
| 5            | 17                          | 24         | 10                         | 1           | 11     | 37                        | 15              | —        | 145               |
| 4            | 14                          | 27         | 11                         | —           | 11     | 36                        | 2               | —        | 172               |
| 7            | 12                          | 27         | 6                          | —           | 6      | 29                        | 1               | —        | 144               |
| 4            | 23                          | 40         | 5                          | —           | 5      | 37                        | 1               | 4        | 152               |
| 7            | 41                          | 33         | 3                          | —           | 3      | 38                        | 1               | —        | 173               |
| 46           | 159                         | 238        | 58                         | 11          | 69     | 283                       | 23              | 6        | 1,288             |
| (a)          | (a)                         | (a)        | (a)                        | (a)         | (a)    | (a)                       | (a)             | (a)      | (a)               |
| (a)          | (a)                         | (a)        | (a)                        | (a)         | (a)    | (a)                       | (a)             | (a)      | (a)               |
| (a)          | (a)                         | (a)        | (a)                        | (a)         | (a)    | (a)                       | (a)             | (a)      | (a)               |
| (a)          | (a)                         | (a)        | (a)                        | (a)         | (a)    | (a)                       | (a)             | (a)      | (a)               |
| (a)          | (a)                         | (a)        | (a)                        | (a)         | (a)    | (a)                       | (a)             | (a)      | (a)               |
| (a)          | (a)                         | (a)        | (a)                        | (a)         | (a)    | (a)                       | (a)             | (a)      | (a)               |
| 4            | 16                          | 31         | 10                         | 1           | 11     | 51                        | 1               | 19       | 338               |
| 6            | 35                          | 26         | 6                          | —           | 6      | 56                        | 1               | —        | 273               |
| 10           | 51                          | 57         | 16                         | 1           | 17     | 107                       | 2               | 19       | 611               |
| 9            | 24                          | 40         | 25                         | —           | 25     | 47                        | 1               | 2        | 154               |
| 11           | 20                          | 25         | 10                         | —           | 10     | 32                        | 9               | —        | 159               |
| 8            | 25                          | 25         | 13                         | —           | 13     | 23                        | 1               | 2        | 204               |
| 9            | 16                          | 31         | 11                         | 1           | 12     | 34                        | 5               | 3        | 210               |
| 7            | 20                          | 18         | 11                         | —           | 11     | 43                        | 1               | 1        | 169               |
| 13           | 12                          | 25         | 6                          | —           | 6      | 42                        | 1               | 2        | 175               |
| 11           | 19                          | 28         | 6                          | 2           | 8      | 35                        | 9               | 1        | 139               |
| 16           | 11                          | 45         | 12                         | —           | 12     | 39                        | 2               | 7        | 172               |
| 84           | 147                         | 237        | 94                         | 3           | 97     | 295                       | 29              | 18       | 1,382             |
| 73           | 68                          | 163        | 114                        | 5           | 119    | 216                       | 13              | 17       | 1,005             |
| 47           | 62                          | 107        | 60                         | 11          | 71     | 173                       | —               | 2        | 969               |
| 53           | 64                          | 151        | 111                        | 2           | 113    | 196                       | 24              | 28       | 982               |
| 55           | 61                          | 201        | 98                         | 4           | 102    | 214                       | 13              | 13       | 1,044             |
| 53           | 50                          | 142        | 83                         | 4           | 87     | 236                       | 2               | 7        | 894               |
| 50           | 52                          | 194        | 89                         | 5           | 94     | 180                       | 26              | 33       | 888               |
| 44           | 51                          | 158        | 71                         | 4           | 75     | 166                       | 21              | 12       | 964               |
| 42           | 59                          | 180        | 86                         | 2           | 88     | 207                       | 15              | 17       | 1,045             |
| 417          | 467                         | 1,296      | 712                        | 37          | 749    | 1,588                     | 114             | 124      | 7,791             |
| 7            | 49                          | 75         | 34                         | 1           | 35     | 101                       | 2               | 23       | 499               |
| 12           | 46                          | 56         | 20                         | 1           | 21     | 92                        | 19              | —        | 458               |
| 7            | 26                          | 41         | 17                         | —           | 17     | 93                        | —               | 3        | 401               |
| 9            | 28                          | 71         | 25                         | —           | 25     | 89                        | 12              | 16       | 389               |
| 7            | 29                          | 64         | 20                         | —           | 20     | 112                       | 5               | —        | 393               |
| 6            | 50                          | 67         | 24                         | —           | 24     | 92                        | 5               | 8        | 417               |
| 10           | 34                          | 72         | 13                         | —           | 13     | 79                        | 34              | 3        | 457               |
| 7            | 43                          | 72         | 27                         | —           | 27     | 96                        | 5               | 7        | 581               |
| 65           | 305                         | 518        | 180                        | 2           | 182    | 754                       | 82              | 60       | 3,595             |
| 24           | 31                          | 92         | 36                         | 2           | 38     | 126                       | 7               | 21       | 660               |
| 31           | 48                          | 90         | 36                         | 2           | 38     | 115                       | 3               | 1        | 578               |
| 26           | 43                          | 117        | 42                         | —           | 42     | 126                       | 18              | 18       | 568               |
| 15           | 35                          | 82         | 31                         | —           | 31     | 124                       | 12              | 9        | 610               |
| 17           | 34                          | 109        | 35                         | 1           | 36     | 130                       | 6               | 1        | 585               |
| 22           | 79                          | 129        | 40                         | —           | 40     | 128                       | 1               | 28       | 661               |
| 36           | 59                          | 114        | 24                         | 1           | 25     | 124                       | 33              | 11       | 655               |
| 20           | 41                          | 97         | 35                         | 3           | 38     | 141                       | 8               | 13       | 810               |
| 191          | 370                         | 830        | 279                        | 9           | 288    | 1,014                     | 88              | 102      | 5,127             |

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TABLE IV.—SUMMARY OF TOTAL DEATHS (ALL AGES) FROM SPECIFIED

| Locality and year.       | All causes. | Diseases of early infancy and congenital malformations. |                           |        | Diarrhea, enteritis, and gastritis. |            |        |
|--------------------------|-------------|---------------------------------------------------------|---------------------------|--------|-------------------------------------|------------|--------|
|                          |             | Diseases of early infancy.                              | Congenital malformations. | Total. | Diarrhea and enteritis.             | Gastritis. | Total. |
| MASSACHUSETTS—continued. |             |                                                         |                           |        |                                     |            |        |
| Lowell:                  |             |                                                         |                           |        |                                     |            |        |
| 1900.....                | 1,848       | 124                                                     | 18                        | 142    | 223                                 | 13         | 236    |
| 1901.....                | 2,041       | 150                                                     | 7                         | 157    | 208                                 | 16         | 224    |
| 1902.....                | 1,943       | 145                                                     | 16                        | 161    | 212                                 | 13         | 225    |
| 1903.....                | 1,943       | 130                                                     | 14                        | 144    | 265                                 | 11         | 276    |
| 1904.....                | 1,738       | 126                                                     | 17                        | 143    | 237                                 | 9          | 246    |
| 1905.....                | 1,901       | 98                                                      | 21                        | 119    | 271                                 | 17         | 288    |
| 1906.....                | 1,919       | 109                                                     | 16                        | 125    | 260                                 | 9          | 269    |
| 1907.....                | 2,062       | 133                                                     | 18                        | 151    | 244                                 | 15         | 259    |
| Total.....               | 15,395      | 1,015                                                   | 127                       | 1,142  | 1,920                               | 103        | 2,023  |
| New Bedford:             |             |                                                         |                           |        |                                     |            |        |
| 1900.....                | 1,325       | 124                                                     | 6                         | 130    | 193                                 | 8          | 201    |
| 1901.....                | 1,249       | 103                                                     | 4                         | 107    | 144                                 | 1          | 145    |
| 1902.....                | 1,364       | 122                                                     | 5                         | 127    | 178                                 | 4          | 182    |
| 1903.....                | 1,002       | 111                                                     | 8                         | 119    | 194                                 | 6          | 200    |
| 1904.....                | 1,366       | 114                                                     | 12                        | 126    | 182                                 | 16         | 198    |
| 1905.....                | 1,297       | 122                                                     | 4                         | 126    | 158                                 | 6          | 164    |
| 1906.....                | 1,367       | 139                                                     | 5                         | 144    | 197                                 | 5          | 202    |
| 1907.....                | 1,550       | 122                                                     | 6                         | 128    | 243                                 | 6          | 249    |
| Total.....               | 11,120      | 957                                                     | 50                        | 1,007  | 1,489                               | 52         | 1,541  |
| NEW HAMPSHIRE.           |             |                                                         |                           |        |                                     |            |        |
| Manchester:              |             |                                                         |                           |        |                                     |            |        |
| 1900.....                | 1,154       | 88                                                      | 4                         | 92     | 164                                 | 10         | 174    |
| 1901.....                | 1,077       | 39                                                      | 9                         | 48     | 154                                 | 7          | 161    |
| 1902.....                | 1,057       | 44                                                      | 6                         | 50     | 131                                 | 4          | 135    |
| 1903.....                | 1,065       | 42                                                      | 6                         | 48     | 151                                 | 12         | 163    |
| 1904.....                | 977         | 62                                                      | 14                        | 76     | 116                                 | 9          | 125    |
| 1905.....                | 1,246       | 74                                                      | 15                        | 89     | 158                                 | 7          | 165    |
| 1906.....                | 1,256       | 109                                                     | 13                        | 122    | 110                                 | 13         | 123    |
| 1907.....                | 1,234       | 130                                                     | 10                        | 140    | 116                                 | 4          | 120    |
| Total.....               | 9,116       | 588                                                     | 77                        | 665    | 1,100                               | 66         | 1,166  |
| RHODE ISLAND.            |             |                                                         |                           |        |                                     |            |        |
| Pawtucket:               |             |                                                         |                           |        |                                     |            |        |
| 1900.....                | 778         | 27                                                      | 3                         | 30     | 79                                  | 6          | 85     |
| 1901.....                | 664         | 35                                                      | 4                         | 39     | 59                                  | 10         | 69     |
| 1902.....                | 737         | 17                                                      | 8                         | 25     | 64                                  | 7          | 71     |
| 1903.....                | 662         | 25                                                      | 13                        | 38     | 75                                  | 6          | 81     |
| 1904.....                | 681         | 26                                                      | 7                         | 33     | 50                                  | 7          | 57     |
| 1905.....                | 725         | 32                                                      | 5                         | 37     | 67                                  | 3          | 70     |
| 1906.....                | 718         | 31                                                      | 5                         | 36     | 63                                  | 5          | 68     |
| 1907.....                | 841         | 29                                                      | 8                         | 37     | 76                                  | 5          | 81     |
| Total.....               | 5,806       | 222                                                     | 53                        | 275    | 533                                 | 49         | 582    |
| Woonsocket:              |             |                                                         |                           |        |                                     |            |        |
| 1900.....                | 554         | 25                                                      | 5                         | 30     | 134                                 | 3          | 137    |
| 1901.....                | 479         | 42                                                      | 4                         | 46     | 92                                  | 5          | 97     |
| 1902.....                | 546         | 35                                                      | 4                         | 39     | 81                                  | 4          | 85     |
| 1903.....                | 489         | 27                                                      | 4                         | 31     | 62                                  | 5          | 67     |
| 1904.....                | 465         | 25                                                      | 5                         | 30     | 47                                  | 5          | 52     |
| 1905.....                | 489         | 30                                                      | 3                         | 33     | 92                                  | 4          | 96     |
| 1906.....                | 539         | 43                                                      | 1                         | 44     | 89                                  | 1          | 90     |
| 1907.....                | 444         | 24                                                      | 4                         | 28     | 85                                  | 1          | 86     |
| Total.....               | 3,996       | 251                                                     | 30                        | 281    | 682                                 | 28         | 710    |

CAUSES, IN 11 NEW ENGLAND TEXTILE TOWNS, 1900 TO 1907—Concluded.

| Convulsions. | Non-tuberculous meningitis. | Pneumonia. | Bronchitis and laryngitis. |             |        | Tuberculosis (all forms). | Whooping cough. | Measles. | All other causes. |
|--------------|-----------------------------|------------|----------------------------|-------------|--------|---------------------------|-----------------|----------|-------------------|
|              |                             |            | Bronchitis.                | Laryngitis. | Total. |                           |                 |          |                   |
| 41           | 63                          | 162        | 85                         | 4           | 89     | 201                       | 1               | 1        | 912               |
| 43           | 70                          | 198        | 69                         | 1           | 70     | 174                       | 15              | 22       | 1,068             |
| 43           | 75                          | 160        | 73                         | .....       | 73     | 170                       | 8               | 9        | 1,019             |
| 32           | 63                          | 143        | 66                         | .....       | 66     | 152                       | 16              | 1        | 1,050             |
| 19           | 55                          | 138        | 65                         | 1           | 66     | 156                       | 3               | 19       | 893               |
| 32           | 94                          | 133        | 63                         | .....       | 63     | 179                       | 17              | 8        | 968               |
| 29           | 69                          | 176        | 74                         | 1           | 75     | 170                       | 10              | 20       | 976               |
| 30           | 41                          | 161        | 81                         | 1           | 82     | 177                       | 14              | 9        | 1,138             |
| 269          | 530                         | 1,271      | 576                        | 8           | 584    | 1,379                     | 84              | 89       | 8,024             |
| 32           | 55                          | 95         | 41                         | .....       | 41     | 118                       | 14              | 14       | 625               |
| 25           | 42                          | 69         | 51                         | 2           | 53     | 160                       | 1               | 4        | 643               |
| 25           | 47                          | 95         | 60                         | 5           | 65     | 130                       | 17              | 5        | 671               |
| 30           | 50                          | 110        | 56                         | 5           | 61     | 143                       | 17              | 11       | 861               |
| 35           | 32                          | 81         | 32                         | .....       | 32     | 167                       | 10              | 2        | 683               |
| 29           | 25                          | 82         | 34                         | .....       | 34     | 140                       | 10              | 1        | 686               |
| 32           | 42                          | 67         | 44                         | .....       | 44     | 158                       | 11              | 5        | 662               |
| 31           | 62                          | 78         | 69                         | .....       | 69     | 152                       | 10              | 5        | 766               |
| 239          | 355                         | 677        | 387                        | 12          | 399    | 1,168                     | 90              | 47       | 5,597             |
| 32           | 49                          | 95         | 38                         | 1           | 39     | 131                       | 3               | .....    | 539               |
| 17           | 52                          | 79         | 33                         | 2           | 35     | 114                       | 12              | .....    | 559               |
| 28           | 51                          | 106        | 55                         | 1           | 56     | 91                        | 6               | 5        | 529               |
| 24           | 32                          | 90         | 37                         | 2           | 39     | 99                        | 18              | 1        | 551               |
| 12           | 33                          | 73         | 32                         | .....       | 32     | 110                       | 7               | .....    | 509               |
| 15           | 154                         | 76         | 20                         | 1           | 21     | 122                       | 6               | 12       | 636               |
| 9            | 72                          | 84         | 35                         | 6           | 41     | 111                       | 21              | .....    | 673               |
| 18           | 49                          | 82         | 49                         | 2           | 51     | 99                        | 25              | 8        | 642               |
| 155          | 492                         | 685        | 299                        | 15          | 314    | 877                       | 98              | 26       | 4,638             |
| 3            | 24                          | 49         | 28                         | 1           | 29     | 76                        | 4               | 13       | 465               |
| 3            | 23                          | 58         | 23                         | .....       | 23     | 74                        | .....           | 1        | 374               |
| 5            | 31                          | 45         | 26                         | .....       | 26     | 75                        | 9               | 4        | 446               |
| 6            | 22                          | 41         | 25                         | .....       | 25     | 75                        | 9               | 3        | 362               |
| 5            | 12                          | 46         | 25                         | .....       | 25     | 75                        | .....           | 1        | 427               |
| 2            | 8                           | 72         | 22                         | 1           | 23     | 86                        | 6               | 4        | 417               |
| 2            | 17                          | 55         | 21                         | .....       | 21     | 73                        | 5               | 5        | 436               |
| 4            | 7                           | 66         | 27                         | .....       | 27     | 101                       | 3               | 1        | 514               |
| 30           | 144                         | 432        | 197                        | 2           | 199    | 635                       | 36              | 32       | 3,441             |
| 8            | 19                          | 37         | 18                         | 1           | 19     | 64                        | 5               | 1        | 234               |
| 4            | 17                          | 28         | 15                         | .....       | 15     | 59                        | 1               | 3        | 209               |
| 5            | 14                          | 43         | 19                         | 2           | 21     | 73                        | 1               | 1        | 264               |
| 1            | 6                           | 44         | 19                         | 3           | 22     | 68                        | 13              | .....    | 237               |
| 3            | 14                          | 60         | 12                         | .....       | 12     | 72                        | 3               | 3        | 216               |
| 1            | 11                          | 39         | 12                         | .....       | 12     | 75                        | 3               | 3        | 213               |
| 4            | 6                           | 53         | 18                         | .....       | 18     | 75                        | 4               | 1        | 235               |
| 4            | 4                           | 39         | 8                          | 1           | 9      | 43                        | 4               | .....    | 227               |
| 30           | 91                          | 343        | 121                        | 7           | 128    | 529                       | 34              | 15       | 1,835             |























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